ACS 800

Hardware Manual
ACS800-17 Drives (75 to 1120 kW)

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Hardware Manual

3AFE 64681338 Rev B
EN
EFFECTIVE: 10.3.2003

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Safety instructions

What this chapter contains

This chapter contains safety instructions you must follow when installing, operating and servicing the drive. If ignored, physical injury or death may follow, or damage may occur to the drive, the motor or driven equipment. Read the safety instructions before you work on the unit.

Use of warnings and notes

There are two types of safety instructions throughout this manual: warnings and notes. Warnings caution you about conditions which can result in serious injury or death and/or damage to the equipment, and advise on how to avoid the danger. Notes draw attention to a particular condition or fact, or give information on a subject. The warning symbols are used as follows:

Dangerous voltage warning warns of high voltages which can cause physical injury and/or damage to the equipment.

General warning warns about conditions, other than those caused by electricity, which can result in physical injury and/or damage to the equipment.

Electrostatic discharge warning warns of electrostatic discharge which can damage the equipment.

Installation and maintenance work

These warnings are intended for all who work on the drive, motor cable or motor. Ignoring the instructions can cause physical injury or death.

WARNING!

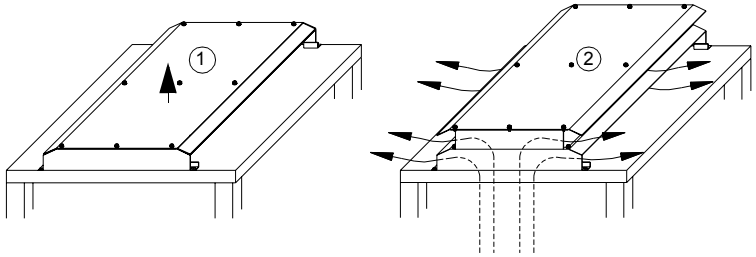
- Only qualified electricians are allowed to install and maintain the drive.
- Never work on the drive, the motor cable or the motor when main power is applied. After switching off the input power, always wait for 5 min to let the intermediate circuit capacitors discharge before you start working on the drive, the motor or the motor cable. Measure the voltage between terminals UDC+ and UDC- with a multimeter (impedance at least 1 Mohm) to ensure that the drive is discharged before beginning work.
- Apply temporary grounding before working on the unit.
- Do not work on the control cables when power is applied to the drive or to the external control circuits. Externally supplied control circuits may cause dangerous voltages to exist inside the drive even when the main power of the drive is switched off.
- Do not make any insulation tests without disconnecting the drive from the cabling first.
- When reconnecting the motor cable, always check that the phase order is correct.
- When joining shipping splits (if any), check the cable connections at the joints before switching on the supply voltage.
- Live parts on the inside of the doors are protected against direct contact. Special attention shall be paid when handling metallic shrouds.

Note:

- The motor cable terminals on the drive are at a dangerously high voltage when the input power is on, regardless of whether the motor is running or not.
- The brake control terminals (UDC+, UDC-, R+ and R- terminals) carry a dangerous DC voltage (over 500 V).
- Depending on the external wiring, dangerous voltages [115 V, 220 V or 230 V] may be present on the relay outputs of the drive system.
- The Prevention of Unexpected Start function does not remove the voltage from the main and auxiliary circuits.

WARNING!

- Make sure that dust from drilling does not enter the drive when installing. Electrically conductive dust inside the unit may cause damage or lead to malfunction.
- Fastening the cabinet by riveting or welding is not recommended. However, if the cabinet is fastened by welding, connecting the return wire improperly may damage electronic circuits in the cabinet. Ensure that welding fumes are not inhaled.
- Ensure sufficient cooling. If the drive is equipped with a double roof, ensure that the roof is lifted up from the transportation position to enable the cooling air flow before starting the drive.



  Air flow from below (from a cable conduit) to the cabinet must be prevented to ensure the degree of protection and fire protection.
- Cooling fans may continue to rotate for a while after the disconnection of the electrical supply.
- Some parts inside the drive cabinet, such as heatsinks of power semiconductors, remain hot for a while after the disconnection of the electrical supply.

WARNING!

- The printed circuit boards contain components sensitive to electrostatic discharge. Wear a grounding wrist band when handling the boards. Do not touch the boards unnecessarily.

Grounding

These instructions are intended for all who are responsible for the grounding of the drive. Incorrect grounding can cause physical injury, death or equipment malfunction and increase electromagnetic interference.

WARNING!

- Ground the drive, the motor and adjoining equipment to ensure personnel safety in all circumstances, and to reduce electromagnetic emission and pick-up.
- Make sure that grounding conductors are adequately sized as required by safety regulations.
- In a multiple-drive installation, connect each drive separately to protective earth (PE).
- Do not install a drive equipped with an EMC (line) filter to an ungrounded power system or a high resistance-grounded (over 30 ohms) power system.

Note:

- Power cable shields are suitable for equipment grounding conductors only when adequately sized to meet safety regulations.
- As the normal leakage current of the drive is higher than 3.5 mA AC or 10 mA DC (stated by EN 50178, 5.2.11.1), a fixed protective earth connection is required.

Fibre optic cables

WARNING!

- Handle the fibre optic cables with care. When unplugging optic cables, always grab the connector, not the cable itself. Do not touch the ends of the fibres with bare hands as the fibre is extremely sensitive to dirt. The maximum allowed bend radius is 25 mm (1 in.).

Operation

These warnings are intended for all who plan the operation of the drive or operate the drive. Ignoring the instructions can cause physical injury or death or damage the equipment.

WARNING!

- If the drive is equipped with an optional brake unit, make sure there are inverters connected to the intermediate circuit before start. As a rule of thumb, the sum capacitance of the inverters connected must be at least 30% of the sum capacitance of all inverters.
- Close the switch fuses of all parallel-connected inverters before start.
- Do not open the DC switch fuse of an inverter when the inverter is running.
- Do not use the Prevention of Unexpected Start feature for stopping the drive when the inverter unit(s) is running. Give a Stop command instead.

WARNING!

- Before adjusting the drive and putting it into service, make sure that the motor and all driven equipment are suitable for operation throughout the speed range provided by the drive. The drive can be adjusted to operate the motor at speeds above and below the speed provided by connecting the motor directly to the power line.
- Do not activate automatic fault reset functions of the Standard Application Program if dangerous situations can occur. When activated, these functions will reset the drive and resume operation after a fault.
- Do not control the motor with the disconnecting device (means); instead, use the control panel keys and , or commands via the I/O board of the drive. The maximum allowed number of charging cycles of the DC capacitors (i.e. power-ups by applying power) is five in ten minutes.

Note:

- If an external source for start command is selected and it is ON, the drive (with Standard Application Program) will start immediately after fault reset unless the drive is configured for 3-wire (a pulse) start/stop.
- When the control location is not set to Local (L not shown in the status row of the display), the stop key on the control panel will not stop the drive. To stop the drive using the control panel, press the LOC/REM key and then the stop key .

Permanent magnet motor

These are additional warnings concerning permanent magnet motor drives.

WARNING! Do not work on the drive when the permanent magnet motor is rotating. Also when the supply power is switched off, a rotating permanent magnet motor feeds power to the intermediate circuit of the drive and also the supply connections become live (even when the inverter is stopped!).

Installation and maintenance work

- Disconnect the motor from the drive with a safety switch

and additionally, if possible,

- lock the motor shaft and ground the motor connection terminals temporarily by connecting them together as well as to the PE.

Operation

Do not run the motor above the rated speed. Motor overspeed leads to overvoltage which may result in explosion of the capacitors in the intermediate circuit of the drive.

Application program

Controlling a permanent magnet motor is only allowed using the ACS 800 Permanent Magnet Synchronous Motor Drive Application Program, or using other application programs in scalar control mode only.

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Introduction

Overview of the manual

Study this manual carefully before installing, commissioning, operating or servicing the drive. We expect that you have a basic knowledge of physical and electrical fundamentals, electrical wiring practices, electrical components and electrical schematic symbols.

ACS800-17 drives consist of a Supply Section and a Drive Section. This manual covers:

- Hardware description of the Drive Section.
- Mechanical and electrical installation of the Supply Section and the Drive Section.
- Commissioning of the Drive Section.
  Note: For Supply Section commissioning, parameters, fault tracing and product information see *IGBT Supply Sections User's Manual* [3BFE 64013700 (English)].
- Preventative maintenance and hardware based fault tracing.
  Note: Fault and warning messages given by the software are described in the *Firmware Manual* or in the *IGBT Supply Sections User's Manual* [3BFE 64013700 (English)].

Other manuals

- *IGBT Supply Sections User's Manual* [3BFE 64013700 (English)]
- *Firmware Manual for ACS 800 Standard Application Program* [64527592 (English)]
- *Application Guide for the Adaptive Programming* [64527274 (English)]
- Option manuals (appropriate manuals is delivered with the option)

Delivery check

Check that there are no signs of damage. Before attempting installation and operation, check the information on the drive nameplate to verify that the unit is of the correct model.

Each drive is fitted with a nameplate for identification purposes. The nameplate data includes a type code and a serial number, which allow individual recognition of each unit. The type code contains information on the size and voltage rating. The first digit of the serial number refers to the manufacturing plant. The next four digits refer to the unit's manufacturing year and week, respectively. The remaining digits complete the serial number so that there are no two units with the same serial number.

Inquiries

Any inquiries about the product should be addressed to the local ABB representative, quoting the type code and the serial number of the unit. If the local ABB representative cannot be contacted, inquiries should be addressed to ABB Oy, Helsinki, Finland.

Hardware description

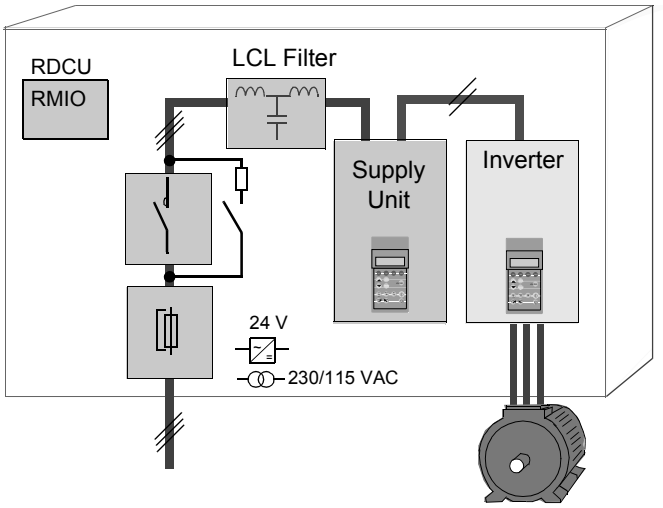
What this chapter contains

This chapter describes the hardware of the ACS800-17.

Main components of the ACS800-17

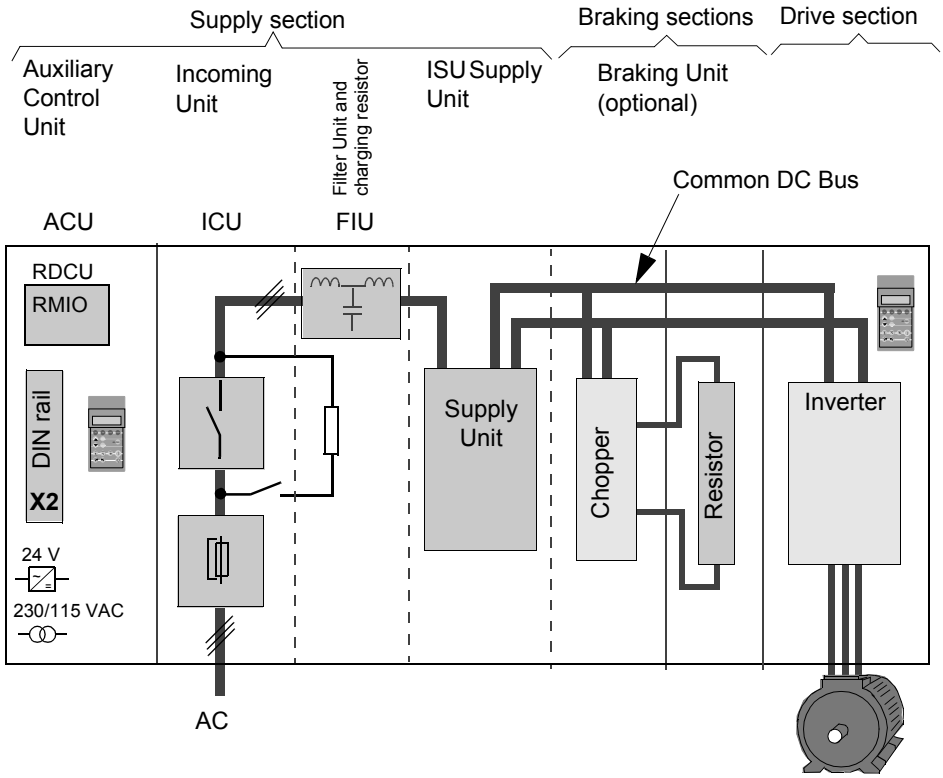
Frame sizes R6i to R9i

The main components of the drive (converter frame sizes R6i to R9i) are shown below. The control panels are optional.



Frame sizes R11i and R12i

The main components of the drive (converter frame sizes R11i and R12i) are shown in the figure below. The Supply Unit is equipped with an IGBT input bridge. The Braking Unit is an optional device. The control panels are optional. For a more detailed description of the Supply Unit, refer to the *IGBT Supply Sections User's Manual*.



Auxiliary control unit

The following components are located in the Auxiliary Control Unit of the ACS800-17:

- Drive Control Unit (RDCU), which includes a Motor and I/O Controller Board (RMIO)
- CDP 31x Control Panel
- control wiring and relays (for e.g. optional prevention of unexpected start-up)
- optional modules (I/O extension and fieldbus adapter modules, pulse encoder interface module etc.)
- other options.

Drive section

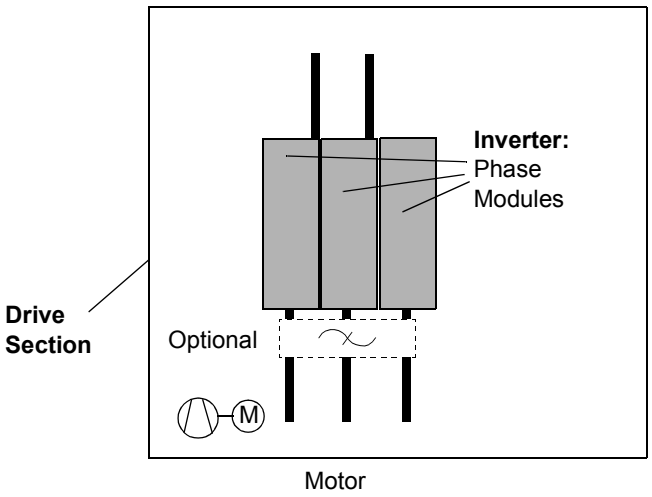
The drive section contains parts listed below:

- inverter
- inverter cooling fans
- Optical Branching Unit (NPBU) with parallel connected units
- du/dt filters (optional)
- output cubicle (with motor cable entry and exit through the top of the cabinet)

- DC fuses (not for all inverter sizes)
- cabinet mechanics.

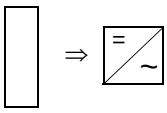
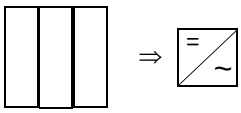
Example

A block diagram of a R11i drive section is shown below.



Inverter

The inverter includes an IGBT output bridge which forms controlled a.c. voltage from the intermediate circuit d.c. voltage. An inverter controls one motor.

Frame Size	An Inverter Unit (ACN 634 xxxx) includes
R6i to R9i	one inverter module (ACN 634 xxxx) ⇒ one inverter 
R11i, R12i	three phase modules (ACN 634 xxxx) = one inverter 

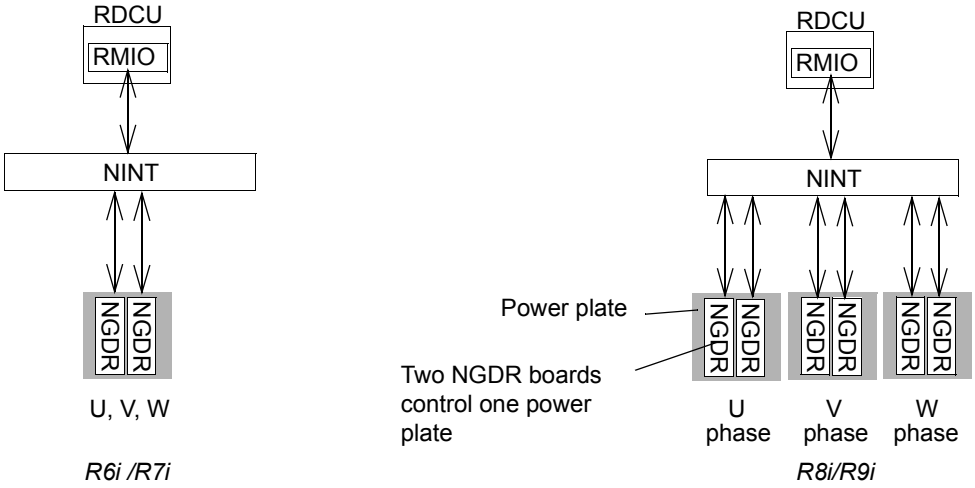
Control boards

One phase module block includes the following boards:

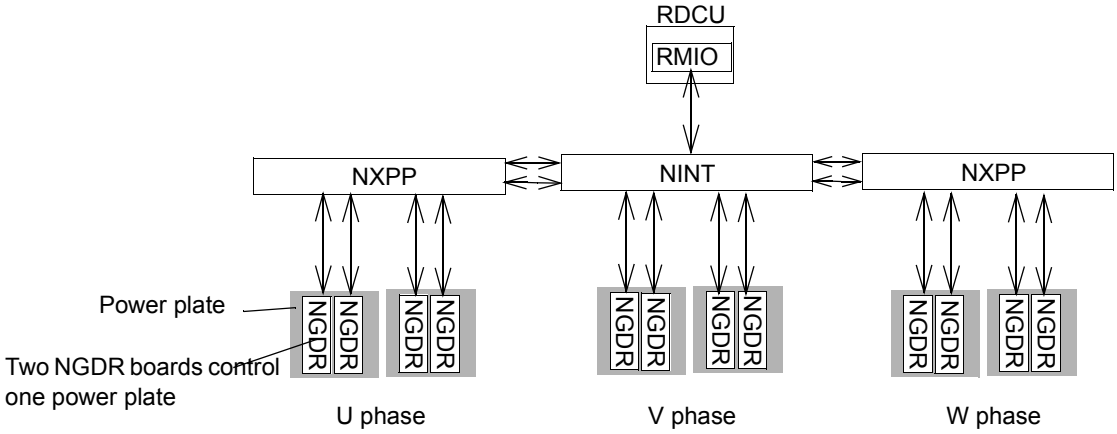
- main circuit interface board (NINT): This board gives the control commands and sends measurement signals.
- two control distribution boards (NXPP, in frame size R11i and up). These boards distribute the control commands given by the NINT board.
- gate driver boards (NGDR). These boards amplify the control pulses for the insulated gate bipolar transistors (IGBTs).

- power supply board for gate drivers (NGPS) in V-phase module
- power supply board (NPOW-62) in V-phase module.

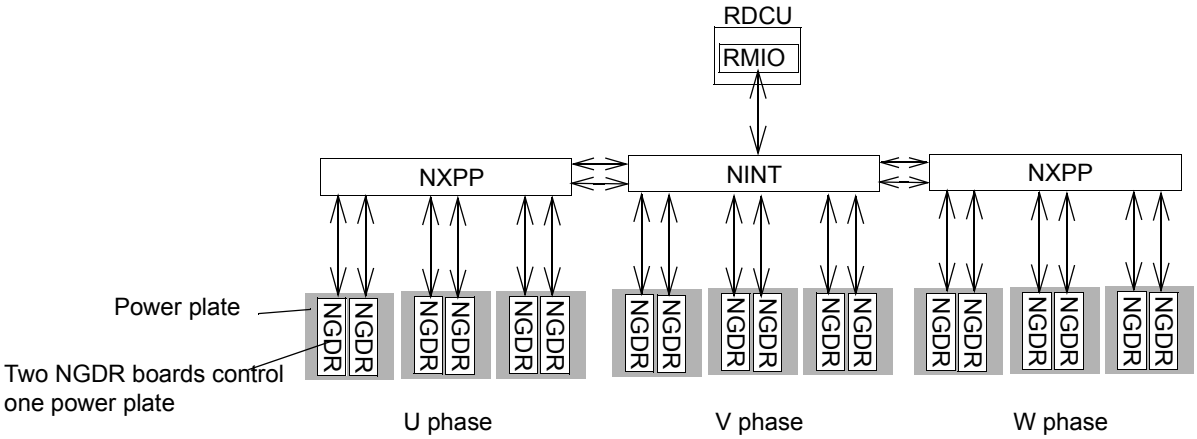
Control board interconnection (frame sizes R6i to R9i)



Control board interconnection (frame size R11i)

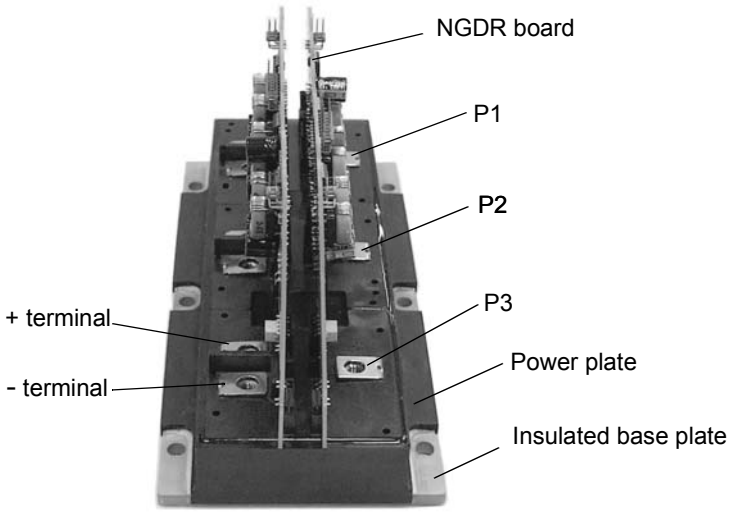


Control board interconnection (frame size R12i)



Power plate

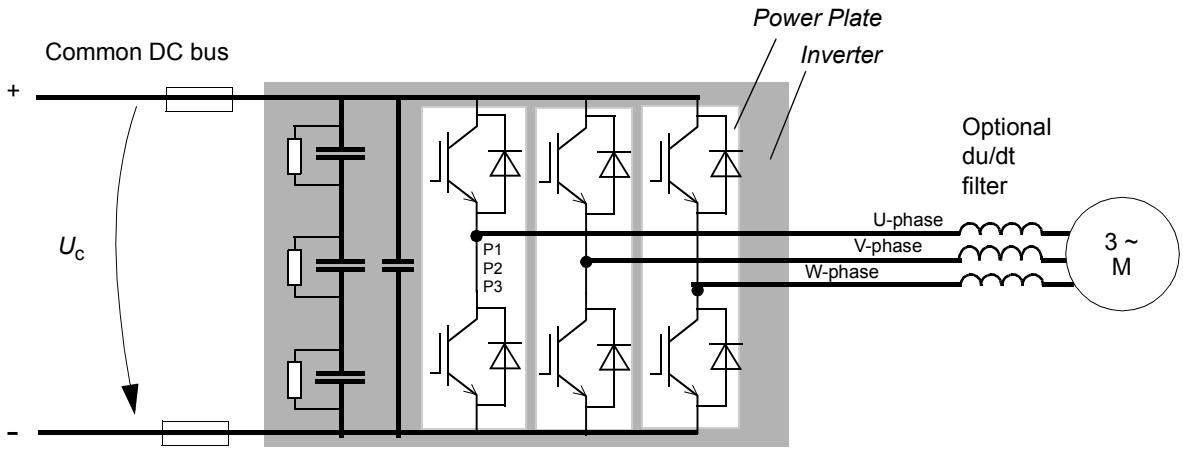
This photo shows one power plate with the NGDR boards connected.



Main circuit diagram

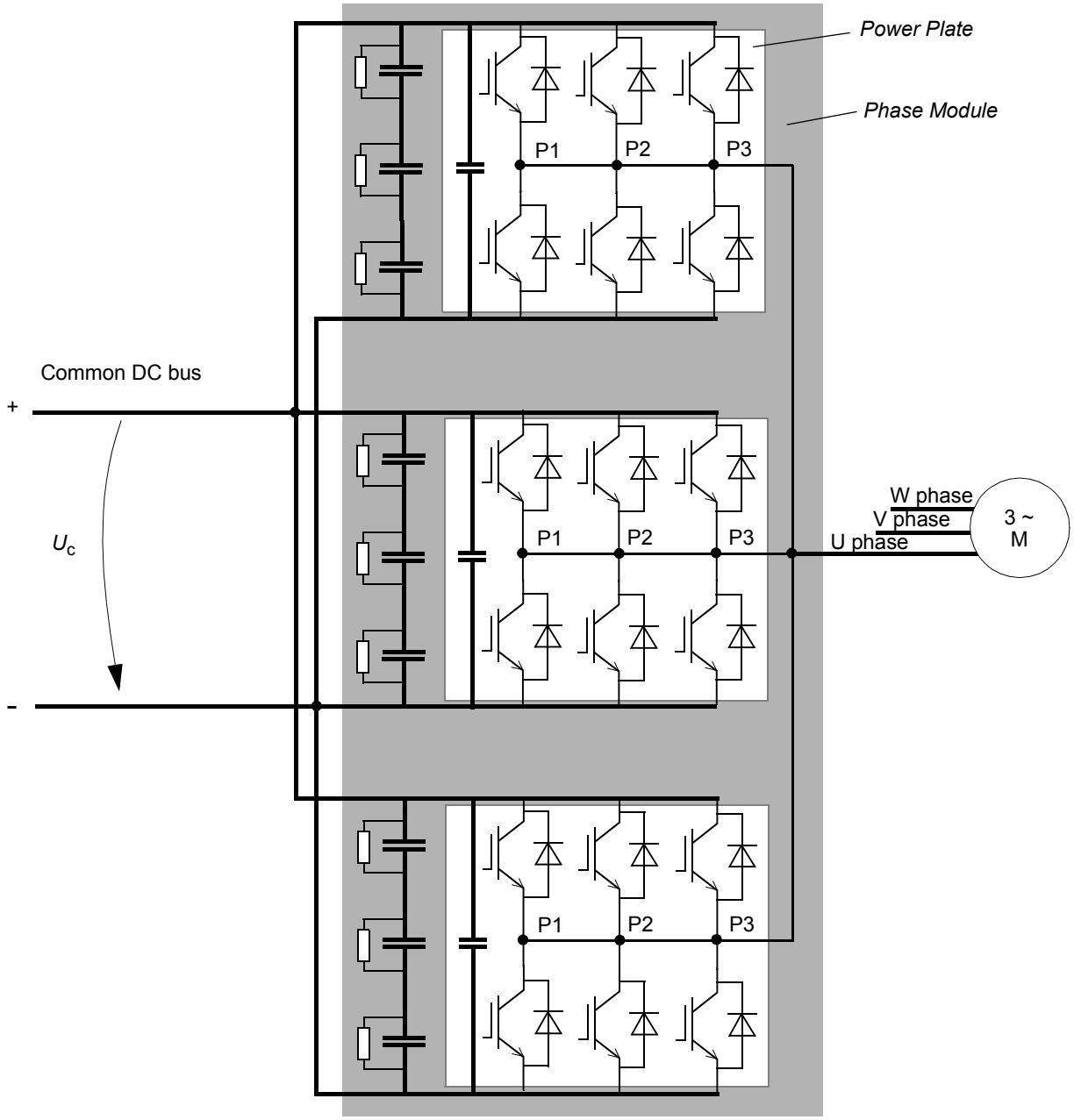
Frame size R8i/R9i

Frame R8i/R9i contains three phase modules, each producing one of the three phases driving the motor.



Frame size R12i

Frame R12i contains three phase modules, each producing one of the three phases driving the motor. Each phase module consists of three parallel connected power plates. Six IGBTs with free wheeling diodes are integrated to a single power plate. The figure below shows the connection of one phase.



Note: DC fuses are included in frames 2 x R11i, 2 x R12i and 4 x R11i only

Voltages from the supply section

The supply section supplies the inverter via the DC busbar. The inverter also takes energy from the DC busbar to make control voltages for the control boards and auxiliary voltage for I/O board.

Voltage for the inverter cooling fans is taken from a 230/115 V a.c. transformer (in the Auxiliary Control Unit) via thermal protection switch.

The 24 V auxiliary voltage source is powered from the 230/115 V a.c. transformer (in the Auxiliary Control Unit).

The emergency stop and the optional uninterrupted power supply (UPS) are wired from the Auxiliary Control Unit.

Use of extra RDIO with frame size R12i

Note: This section concerns drive frame size R12i with **ACS 800 Standard Application Program**.

An additional Digital I/O Extension Module (RDIO) is installed in the drives at the factory. The configuration blocks inverter pulses in case of a 230/115 V auxiliary power supply failure, thus preventing incorrect control of the IGBTs.

The node number of this RDIO module is 7. Other optional modules can be chained with it to channel CH1 as usual.

For more information, refer to *ACA 610 Modification Instruction* [3AFE 64163671 (English)].

Mechanical installation

What this chapter contains

This chapter provides instructions for moving the shipping splits, fastening them to the floor and joining them together. Instructions concerning only some types are marked.

General

See chapter *Technical data* for allowed operating conditions and requirements for free space around the unit.

The drive cabinets should be installed in an upright vertical position.

The floor that the unit is installed on should be of non-flammable material, as smooth as possible, and strong enough to support the weight of the unit. The floor flatness must be checked with a spirit level before the installation of the cabinets into their final position. The maximum allowed deviation from the surface level must be $\leq$ 5 mm measured every 3 m. The installation site should be levelled, if necessary, as the cabinet is not equipped with adjustable feet.

The wall behind the unit should be of non-flammable material.

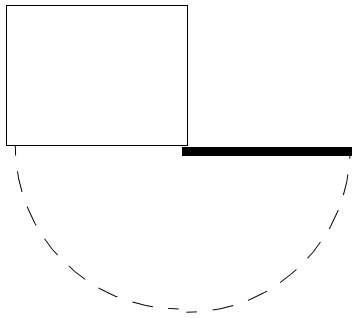
Required tools

The tools required for moving the shipping splits to their final location, fixing them to the floor and tightening the connections are listed below.

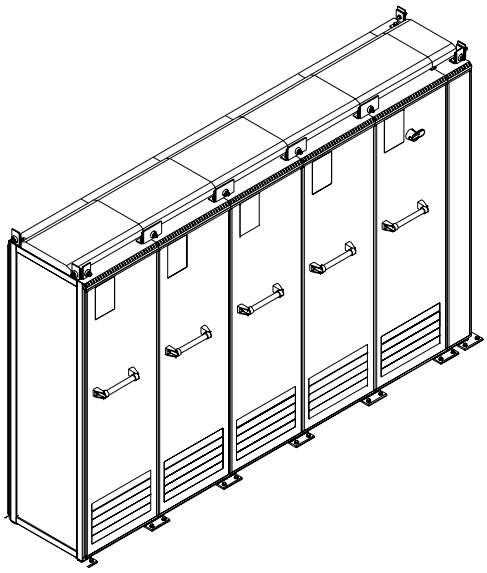
- iron bar and roller tubes or similar for moving a shipping split
- Pozidrive and Torx (2.5–6 mm) screwdrivers for the tightening of the frame screws
- torque wrench
- 19 mm wrench set for tightening the DC horizontal busbars between shipping splits
- 17 mm wrench set for tightening the PE busbars between shipping splits.

Cabinet construction

In marine versions, the cabinet includes, in addition, vibration dampers and handles on the doors.



Cabinet door opening



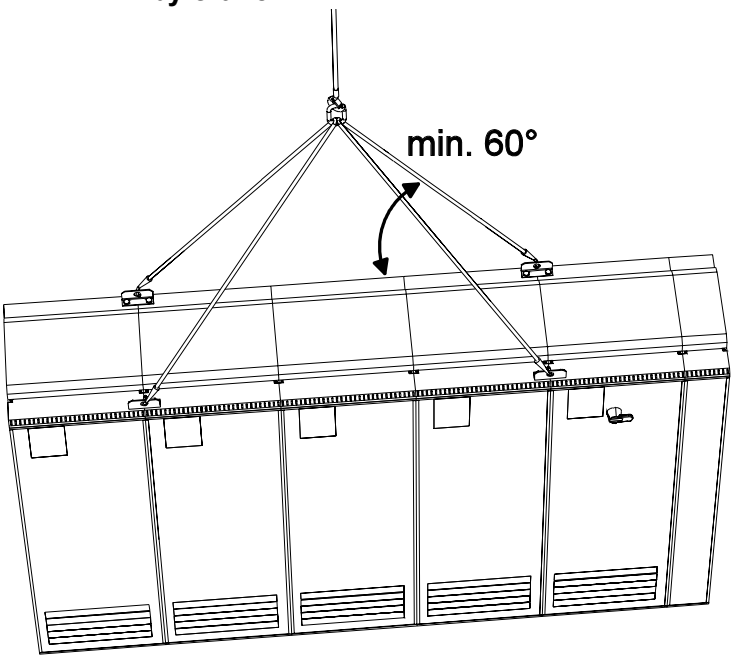
Marine Applications (ACS 800 MarineDrive)

ACS800-17 frame size R7i

ACS800-17 frame size R9i

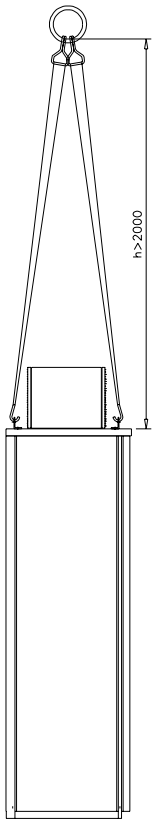
Moving of the shipping split

by crane



Use the steel lifting lugs attached to the top of the cabinets. Insert the lifting ropes or slings into the holes of the lifting lugs.

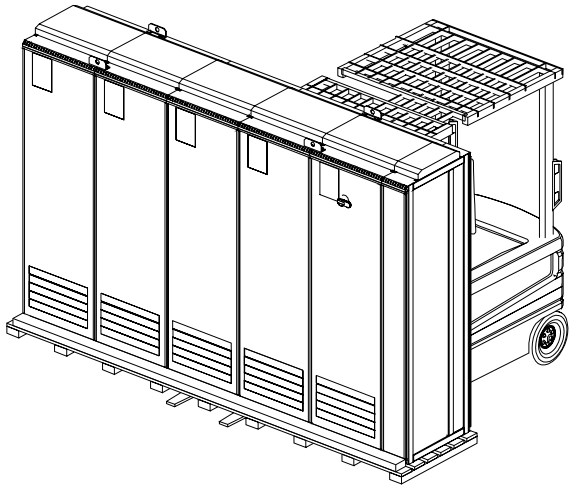
The lifting lugs can be removed (not mandatory) once the cabinets are in their final location. **If the lifting lug is removed, the bolts for each lug must be refastened to maintain the degree of protection of the cabinet.**



ACS800-17: IP 54

Allowed minimum height of lifting ropes or slings for IP 54 shipping splits is 2 metres.

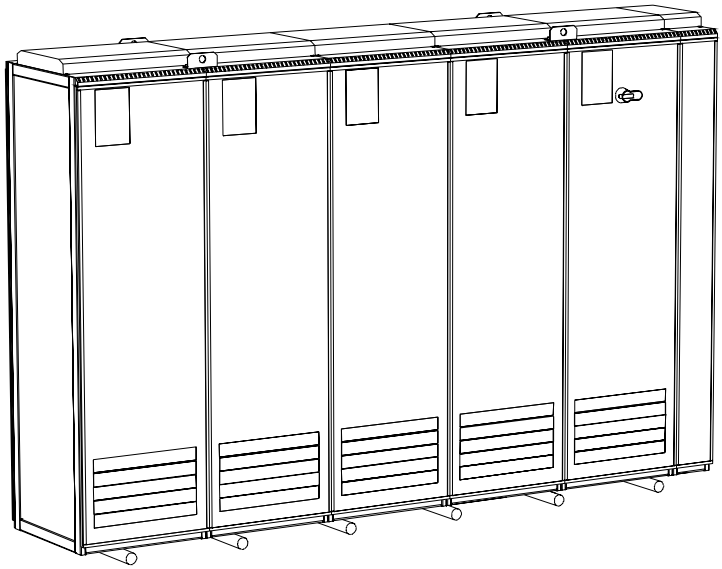
by fork-lift



The centre of gravity may be quite high. Be therefore careful when transporting the shipping splits. Tilting of the cabinets must be avoided.

Moving of the shipping split is to be done only with the cabinets upright.

by split rollers (not allowed in marine versions)

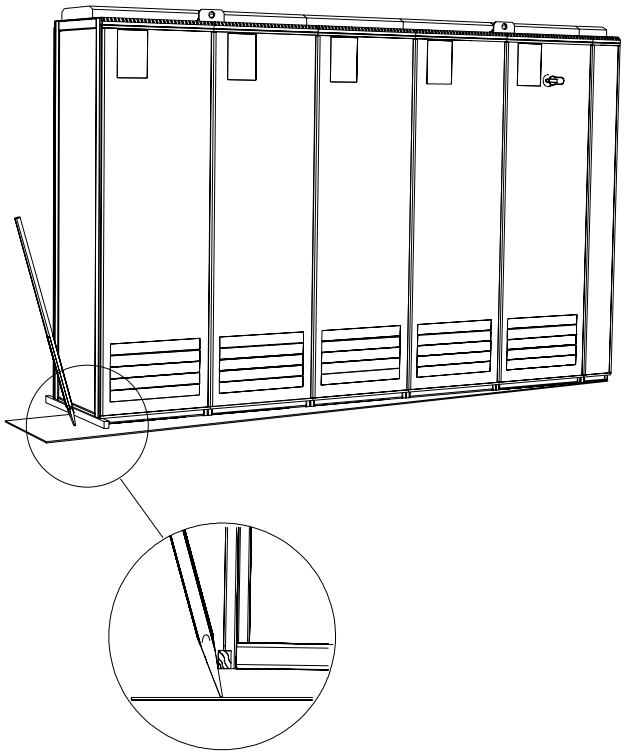


Remove the bottom wooden frame which is part of the shipment.

Lay the shipping split on the rollers and move the unit carefully until it is close to its final location.

Remove the rollers by lifting the shipping split using a crane or fork-lift truck as described above.

Final placement of the shipping splits



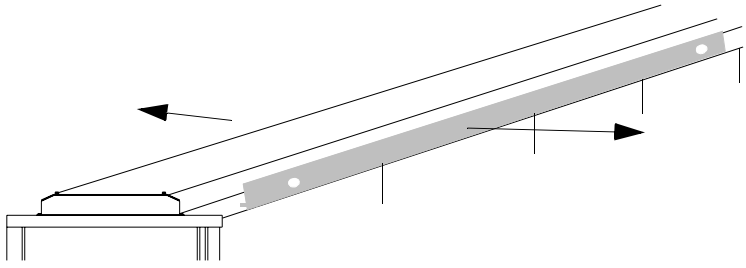
Marine units:

WARNING! Marine units are equipped with vibration dampers below the cabinets which may be damaged when moving. Be careful when moving the cabinets.

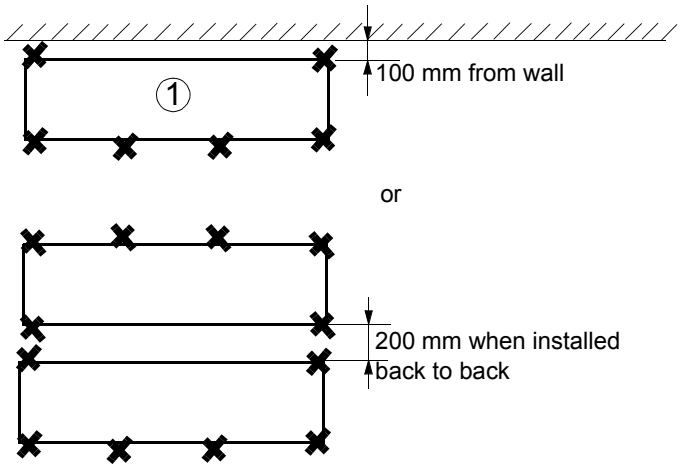
The cabinets can be moved into their final position by using an iron bar and a wooden piece at the bottom edge of the cabinet. Care is to be taken to properly place the wooden piece so as not to damage the cabinet frame.

Removing the lifting lugs and bars

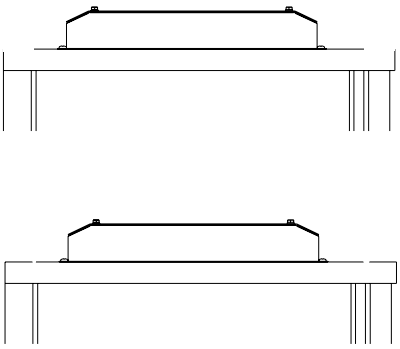
Remove the lifting bars (if used) after lifting, as they disturb the cooling of the unit. Remove the lifting lug of marine versions. **Refasten the original bolts or fasten the upper vibration dampers (if used) in order to maintain the degree of protection of the cabinet.**

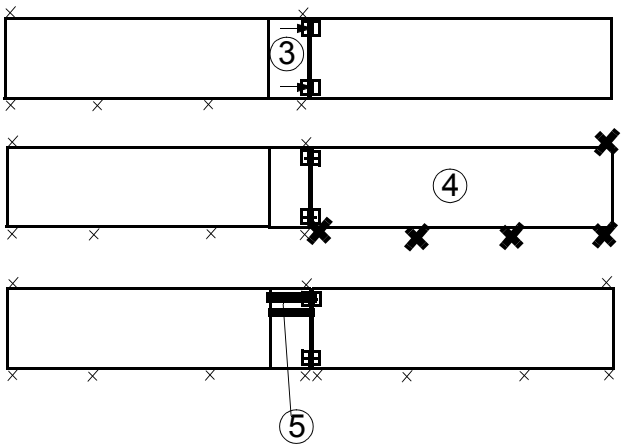


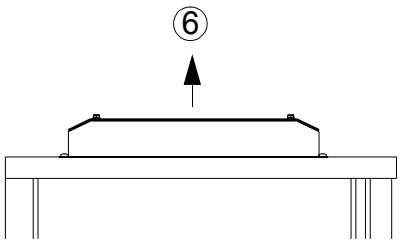
Working order of the mechanical installation



2







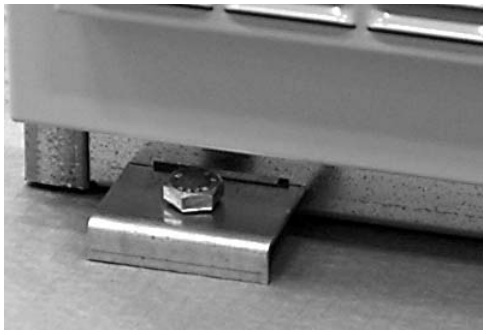
- Fasten the first shipping split to the floor with fastening clamps or through the holes inside the cabinet. See section *Fastening the shipping split to the floor (non-marine units).*
  In marine versions, fasten the first shipping split to the floor and roof/wall as described in section *Fastening the shipping splits to the floor and wall (marine units)*.
  Note: Any height adjustment of the cabinets must be done before fastening the cabinets together. Height adjustment can be done by using metal shims between the bottom frame and floor.
- Remove the lifting bars (if used) and the lifting lugs in marine applications. Place the original bolts or upper vibration dampers to the holes.
- Fasten the first shipping split to the next shipping split. Each shipping split includes a 200/600 mm joining cabinet.
- Fasten the second shipping split to the floor.
- Connect the DC busbars and the PE busbar.
- Lift the upper part of the cabinet roof up (if a double roof exists).

Fastening the shipping split to the floor (non-marine units)

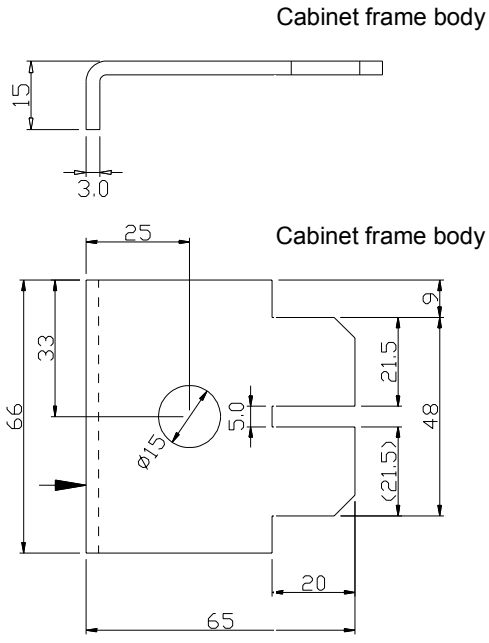
Fastening the shipping split to the floor is especially important in installations subjected to vibration or other movement.

Fastening clamps

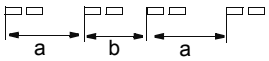
Insert the clamp into the longitudinal hole in the edge of the cabinet frame body and fasten it with a bolt to the floor. Allowed maximum distance between the fastening clamps is 800 mm.



Dimensions of the fastening clamp

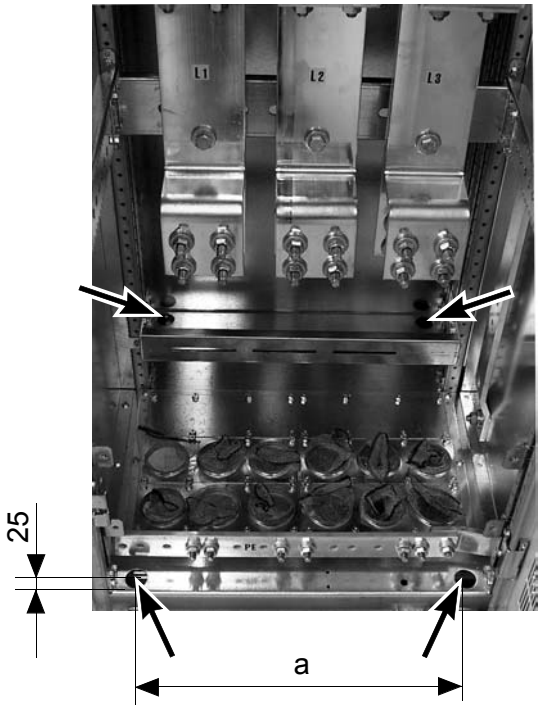


Fastening hole distances for the common cabinet are given below. Fastening bolt: M10 to M12 (3/8” to 1/2”).

Cubicle width	Hole distance (mm) 
200	
400	a: 250
600	a: 450
800	a: 650
1000	a: 350, b: 150, a: 350
1200	a: 450, b: 150, a: 450
1500	a: 350, b: 150, a: 350, b: 150, a: 350

Holes inside the cabinet

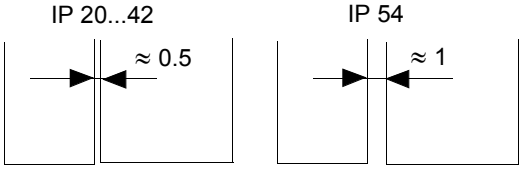
The cabinet can be fastened to the floor using the fastening holes inside the cabinet, if they are available and accessible. The maximum allowed distance between the fastening points is 800 mm.



Fastening holes inside the cabinet

Side plates of the cabinet: 15 mm
Back plate of the cabinet: 10 mm

Gap between the 200 mm, 400 mm, 600 mm, 800 mm, 1000 mm and 1500 mm cubicles:



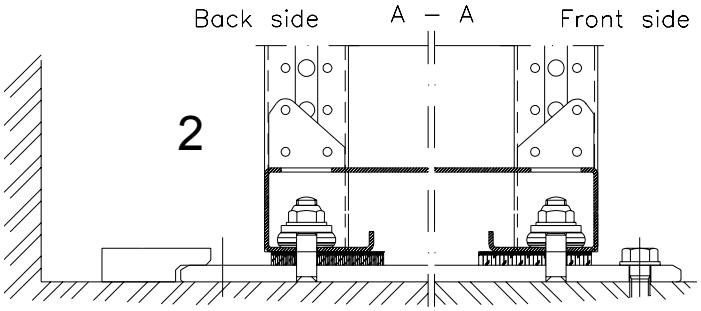
Fastening hole distances for the common cabinet are given below.
Fastening bolt: M10 to M12 (3/8” to 1/2”).

Cubicle width	Hole distance (mm) a b a ∅ 31 mm
200	a: 50
400	a: 250
600	a: 450
800	a: 650
1000	a: 350, b: 150, a: 350
1200	a: 450, b: 150, a: 450
1500	a: 350, b: 150, a: 350, b: 150, a: 350

Fastening the shipping splits to the floor and wall (marine units)

The shipping split must be fastened to the floor and roof (wall) in marine versions as follows.

Use a clamp (not included)

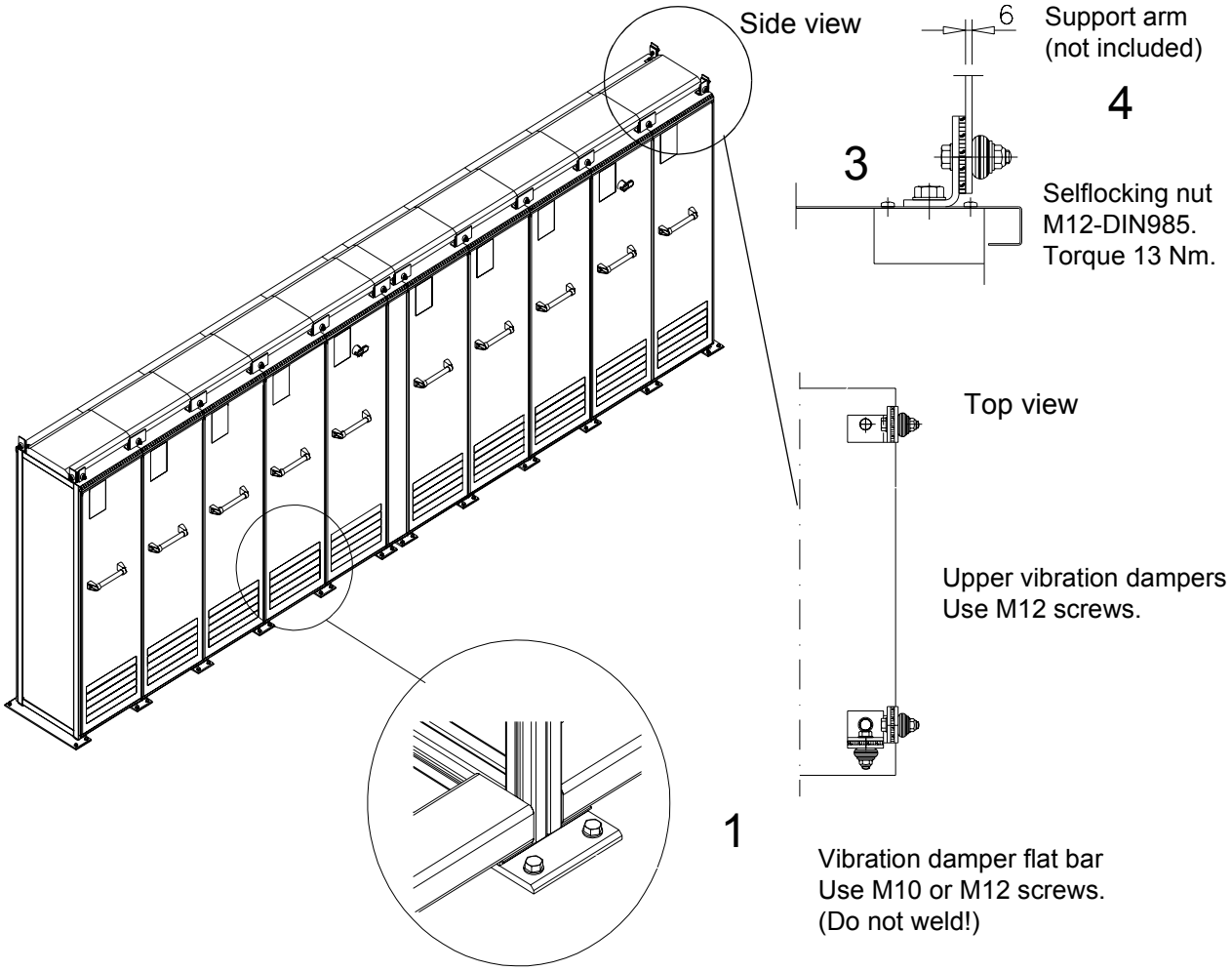


1 Fasten the shipping split to the floor with M10 or M12 bolts through the holes in the vibration damper flat bar.

2 If there is not enough room behind the cabinets for installation, use the fastening method shown in figure (2).

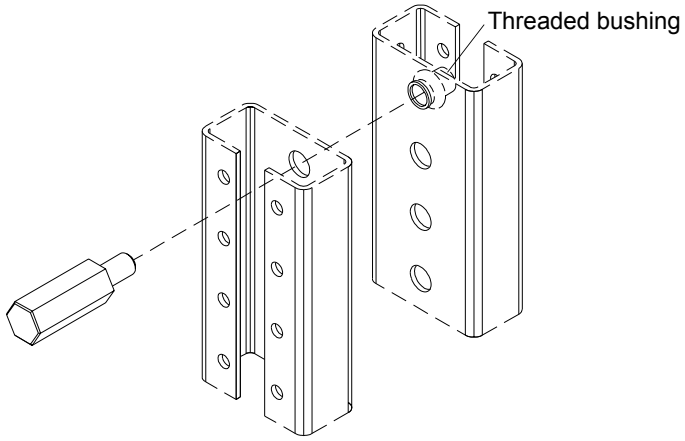
3 Fasten the upper vibration dampers. **For the positions of the upper vibration dampers, see the accompanying dimension drawing of the shipping split!**

4 Fasten the support arms to the upper vibration dampers and roof (wall).

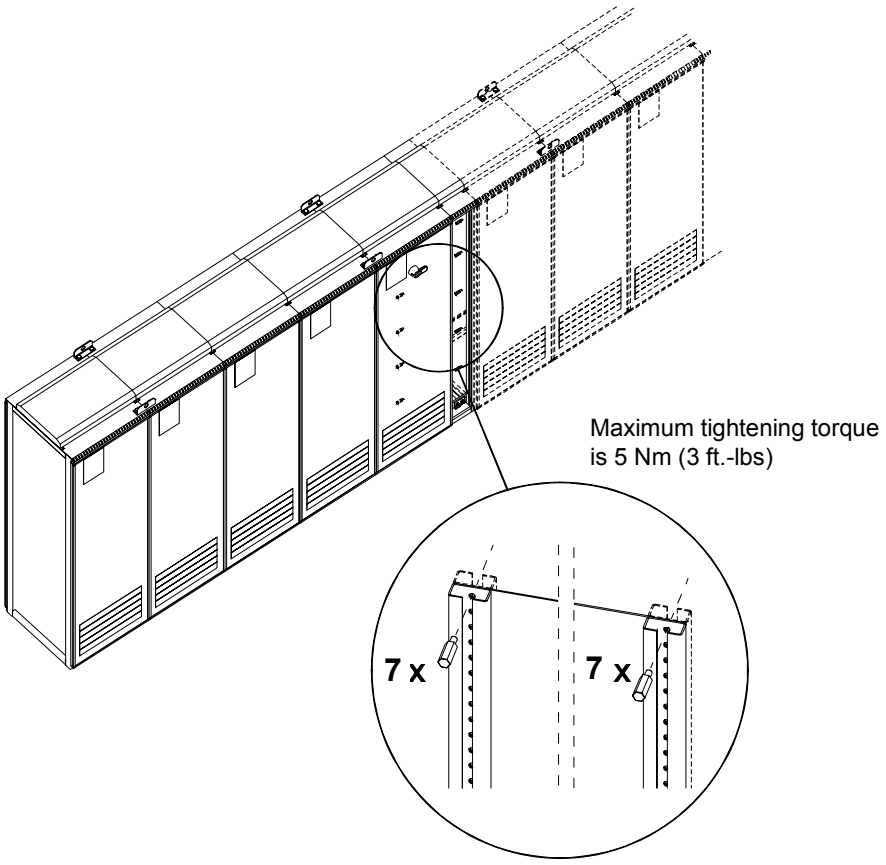


Joining the shipping splits

Shipping splits are joined in the busbar joining section. Special screws (M6) for fastening the cabinets together are enclosed in a plastic bag inside the last cabinet of the shipping split. The threaded bushings are already mounted on the post.

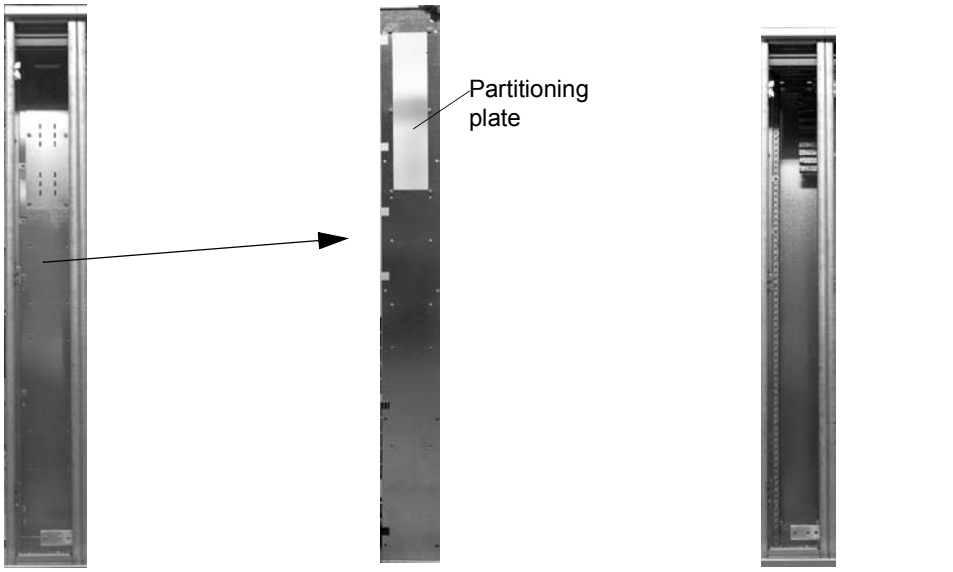


Working order



- Fasten the front post of the joining section with seven screws to the front frame post of the next cabinet.

- 200 mm wide joining section: Remove the intermediate plate hiding the back posts in the joining section. 600 mm wide joining section: Remove the partitioning plates.



- Fasten the back post of the joining section with seven screws (below the busbar joining part) to the post of the next cabinet.
- Replace the intermediate plate (and the partitioning plate(s) in the upper part of it after connecting the DC Busbars, see section *Connecting the DC busbar and the PE busbar*).

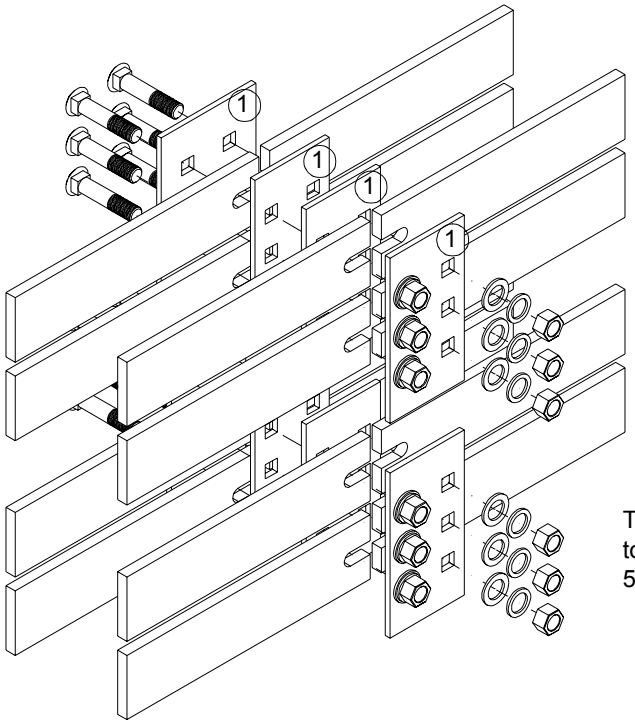
Connecting the DC busbar and the PE busbar

Horizontal main DC busbars and the PE busbar are connected from the front of the 200/600 mm wide busbar joining cabinet. All necessary materials are located in the joining cabinet.

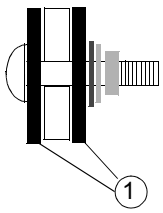
- Remove the front metal partitioning plate located in the busbar joining cabinet.
- Unscrew the bolts of the joint pieces.
- Connect the busbars with the joint pieces (see figure below). For aluminium busbars, joint grease (e.g. TK-Penetral, made by Framatome Connectors USA Inc. Burndy Electrical) must be used to avoid corrosion and to ensure good electrical connection. The oxide layer must be scrubbed off from the joints before applying the grease.
- Replace the front metal plate into its original position because of safety of personnel.

DC busbar

The DC busbar connection is shown below.

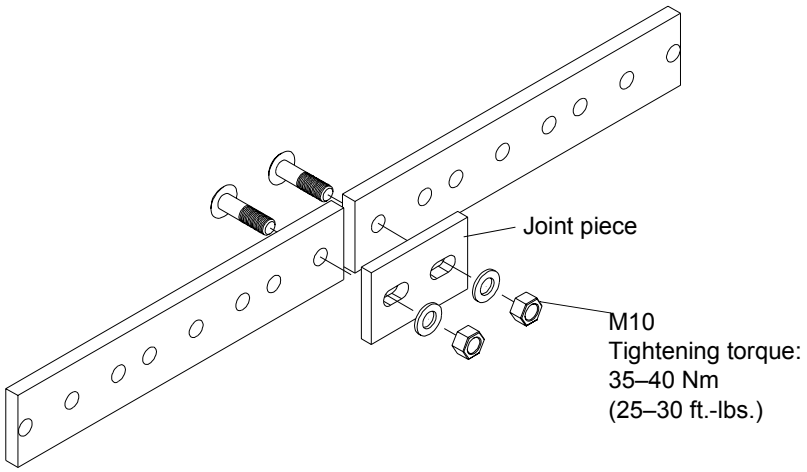


Side view of single busbar connection



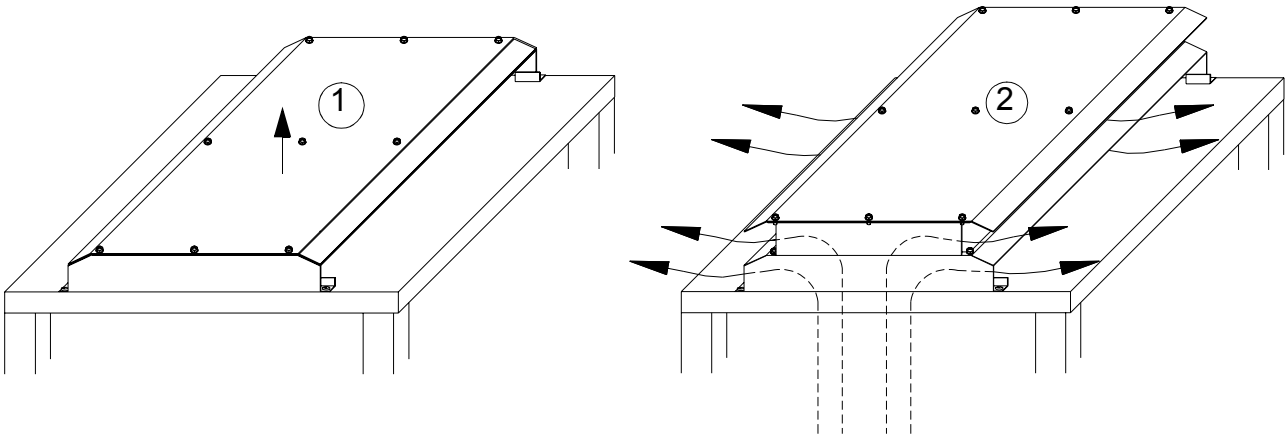
PE busbar

The PE busbar connection is shown below.



Lifting a double roof

When the drive is equipped with a double roof:

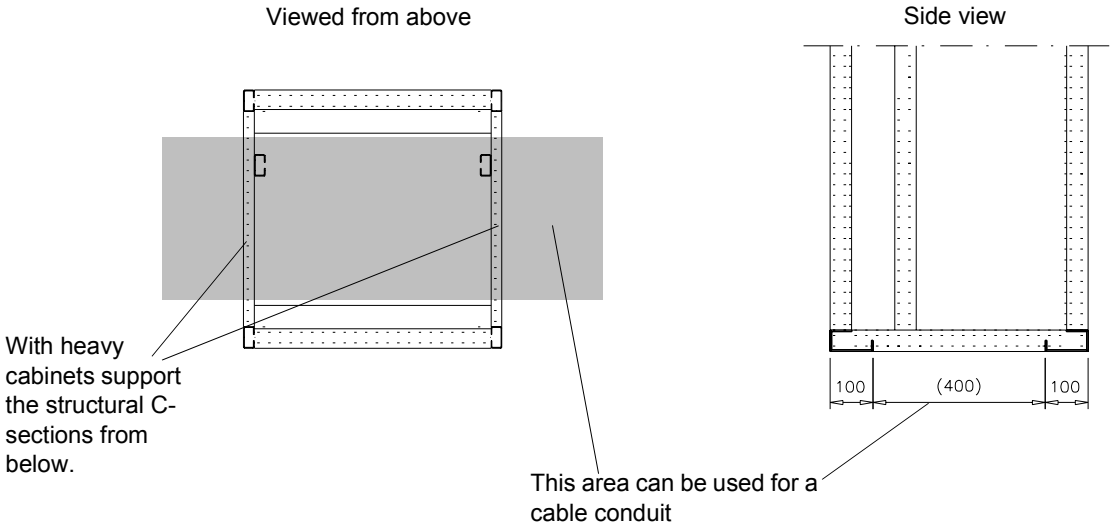


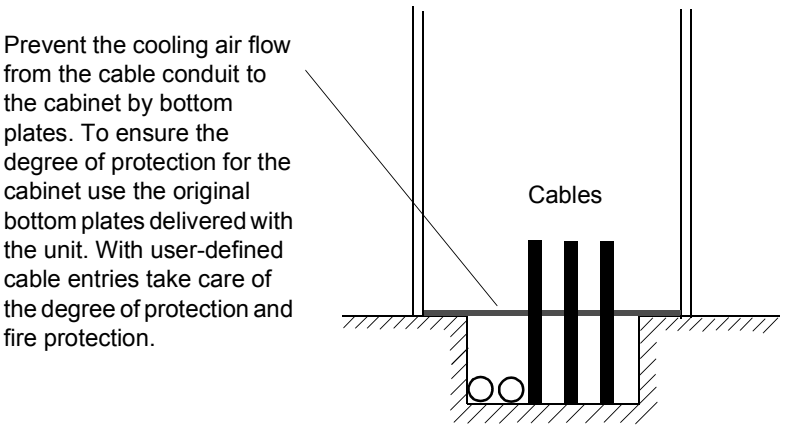
- Lift the upper part of the roof plate up from the transportation position.
- Lock the roof to its final position with the M6 screws.

Miscellaneous

Cable conduit in the floor below the cabinet

A cable conduit can be constructed below the 400 mm wide middle part of the cabinet. The cabinet weight lies on the two 100 mm wide transverse sections which the floor must carry.




Prevent the cooling air flow from the cable conduit to the cabinet by bottom plates. To ensure the degree of protection for the cabinet use the original bottom plates delivered with the unit. With user-defined cable entries take care of the degree of protection and fire protection.
Cables

Electric welding

It is not recommended to fasten the cabinet by welding.

Cabinets without vibration dampers

If the preferred fastening methods (clamps or holes inside the cabinet) can not be used, proceed as follows:

- Connect the return conductor of the welding equipment low to the cabinet frame within 0.5 metres of the welding point.

Cabinets with vibration dampers

If the fastening cannot be done with screws, proceed as follows:

- Weld only the flat bar under the cabinet, never the cabinet frame itself.
- Clamp the welding electrode onto the flat bar about to be welded or onto the floor within 0.5 metres of the welding point. **Do not clamp the electrode on any part of the cabinet frame.**
- Cool the flat bar with a wet cloth so that the heat is not conducted to the vibration dampers.

WARNING! If the welding return wire is connected improperly, the welding circuit may damage electronic circuits in the cabinets or the vibration damper bolts may weld to the cabinet frame. The vibration dampers will be damaged if their temperature exceeds 120 degrees Celsius.

Planning the electrical installation

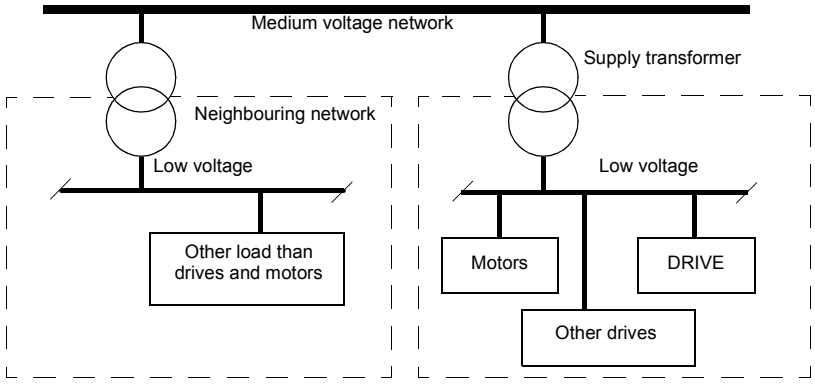
What this chapter contains

This chapter contains the instructions that you must follow when selecting the motor, the cables, the protections, the cable routing and the way of operation for the drive system. Always follow local regulations.

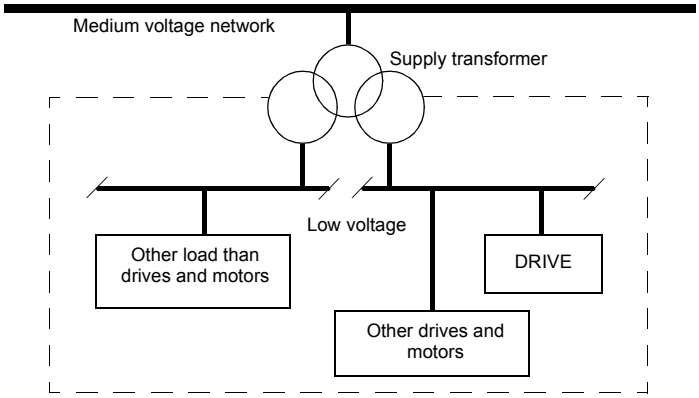
Note: If the recommendations given by ABB are not followed, the drive may experience problems that the warranty does not cover.

Supply

WARNING! Drive systems larger than 500 kVA must be supplied with a transformer dedicated to drives and motors or equipment of equal or higher power, or with a transformer equipped with two secondary windings, one of which is dedicated to drives and motors. Resonances might occur if there is capacitive load (e.g. lighting, PC, PLC, small power factor compensation capacitors) in the same network as the drive. The resonance current may damage a unit in the network.



or



Checking the compatibility of the motor

See *Technical data* for the drive ratings and the motor connection data.

WARNING! Operation is not allowed if the motor nominal voltage is less than 1/2 of the drive nominal input voltage. The allowed range of the motor nominal current is 1/6…2 × I_{2hd} of the drive in DTC control mode or 0…2 × I_{2hd} in scalar control mode.

Protecting the motor winding and bearings

The output of the drive comprises – regardless of output frequency – pulses of approximately 1.35 times the mains network voltage with a very short rise time. This is the case with all drives employing modern IGBT inverter technology.

The voltage of the pulses can be almost double at the motor terminals, depending on the motor cable properties. This in turn can cause additional stress on the motor insulation.

Modern variable speed drives with their fast rising voltage pulses and high switching frequencies can cause current pulses through the motor bearings which can gradually erode the bearing races.

The stress on motor insulation can be avoided by using optional ABB du/dt filters. du/dt filters also reduce bearing currents.

To avoid damage to motor bearings, insulated N-end (non-driven end) bearings and output filters from ABB must be used according to the following table. In addition, the cables must be selected and installed according to the instructions given in this manual. Three types of filters are used individually or in combinations:

- optional du/dt limitation (protects motor insulation system and reduces bearing currents).
- common mode filter (mainly reduces bearing currents)
- light common mode filter (mainly reduces bearing currents).

The common mode filter is composed of toroidal cores installed onto the output busbars inside the drive at the factory.

Requirements table

The following table shows how to select the motor insulation system and when optional ABB du/dt limitation, insulated N-end (non-driven end) motor bearings and ABB common mode filters are required. The motor manufacturer should be consulted regarding the construction of the motor insulation and additional requirements for explosion-safe (EX) motors. Failure of the motor to fulfil the following requirements or improper installation may shorten motor life or damage the motor bearings.

Manufacturer	Motor type	Nominal mains voltage (AC line voltage)	Requirement for			
			Motor insulation system	ABB du/dt limitation, insulated N-end bearing and ABB common mode filter		
				P_N < 100 kW and frame size < IEC 315	**100 kW ≤ P_N < 350 kW** or frame size ≥ IEC 315	**P_N ≥ 350 kW** or frame size ≥ IEC 400
				P_N < 134 HP and frame size < NEMA 500	**134 HP ≤ P_N < 469 HP** or frame size ≥ NEMA 500	**P_N ≥ 469 HP**
ABB	Random-wound M2_ and M3_	U_N ≤ 500 V	Standard	-	+ N	+ N + CMF
		500 V < U_N ≤ 600 V	Standard	+ du/dt	+ du/dt + N	+ du/dt + N + LCMF
			or			
			Reinforced	-	+ N	+ N + CMF
		600 V < U_N ≤ 690 V	Reinforced	+ du/dt	+ du/dt + N	+ du/dt + N + LCMF
	Form-wound HXR and AM_	380 V < U_N ≤ 690 V	Standard	n.a.	+ N + CMF	+ N + CMF
	Old* form-wound HX_ and modular	380 V < U_N ≤ 690 V	Check with the motor manufacturer.	+ du/dt limitation with voltages over 500 V + N + CMF		
	Random-wound HXR and AM_	380 V < U_N ≤ 690 V	Check with the motor manufacturer.	+ du/dt limitation with voltages over 500 V + N + CMF		

Manufacturer	Motor type	Nominal mains voltage (AC line voltage)	Requirement for			
			Motor insulation system	ABB du/dt limitation, insulated N-end bearing and ABB common mode filter		
				P_N < 100 kW and frame size < IEC 315	**100 kW ≤ P_N < 350 kW** or frame size ≥ IEC 315	**P_N ≥ 350 kW** or frame size ≥ IEC 400
				P_N < 134 HP and frame size < NEMA 500	**134 HP ≤ P_N < 469 HP** or frame size ≥ NEMA 500	**P_N ≥ 469 HP**
NON-ABB	Random-wound and form-wound	U_N ≤ 420 V	Standard: $\hat{U}_{LL}$ = 1300 V	-	+ N or CMF	+ N + CMF
		420 V < U_N ≤ 500 V	Standard: $\hat{U}_{LL}$ = 1300 V	+ du/dt	+ du/dt + N or + du/dt + CMF	+ du/dt + N + CMF
			or			
			Reinforced: $\hat{U}_{LL}$ = 1600 V, 0.2 microsecond rise time	-	+ N or CMF	+ N + CMF
		500 V < U_N ≤ 600 V	Reinforced: $\hat{U}_{LL}$ = 1600 V	+ du/dt	+ du/dt + N or + du/dt + CMF	+ du/dt + N + LCMF
			or			
			Reinforced: $\hat{U}_{LL}$ = 1800 V	-	+ N or CMF	+ N + CMF
		600 V < U_N ≤ 690 V	Reinforced: $\hat{U}_{LL}$ = 1800 V	+ du/dt	+ du/dt + N	+ du/dt + N + LCMF
	Form-wound	600 V < U_N ≤ 690 V	Reinforced: $\hat{U}_{LL}$ = 2000 V, 0.3 microsecond rise time	n.a.	N + CMF	N + CMF

* manufactured before 1992

Note 1: The abbreviations used in the table are defined below.

Abbreviation	Definition
U_N	nominal voltage of the supply network
$\hat{U}_{LL}$	peak line-to-line voltage at motor terminals which the motor insulation must withstand
P_N	motor nominal power
du/dt	du/dt filter at the output of the drive or internal du/dt limitation
CMF	common mode filter +E208 (3 toroidal cores)
LCMF	light common mode filter +E209 (1 toroidal core)
N	N-end bearing: insulated motor non-driven end bearing
n.a.	Motors of this power range are not available as standard units. Consult the motor manufacturer.

Note 2: *Explosion-safe (EX) motors*

The motor manufacturer should be consulted regarding the construction of the motor insulation and additional requirements for explosion-safe (EX) motors.

Note 3: *High-output motors and IP 23 motors*

For motors with higher rated output than what is stated for the particular frame size in IEC 50347 (2001) and for IP 23 motors, the requirements of range "100 kW < P_N < 350 kW" apply to motors with P_N < 100 kW. The requirements of range "P_N > 350 kW" apply to motors with P_N within the range of "100 kW < P_N < 350 kW".

Note 4: *HXR and AMA motors*

All AMA machines (manufactured in Helsinki) to be supplied by a drive have form-wound windings. All HXR machines manufactured in Helsinki since 1997 have form-wound windings.

Note 5: *Drives with an IGBT supply unit*

If voltage is raised by the drive, select the motor insulation system according to the increased intermediate circuit DC voltage level, especially in the 500 V (+10%) supply voltage range.

Note 6: *ABB motors of types other than M2_, M3_, HX_ and AM_*

Select according to non-ABB motors.

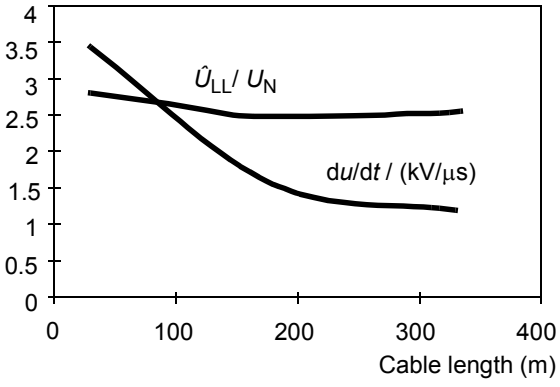
Note 7: *Resistor braking of the drive*

When the drive is in braking mode for a large part of its operation time, the intermediate circuit DC voltage of the drive increases, the effect being similar to increasing the supply voltage by up to 20 percent. The voltage increase should be taken into consideration when determining the motor insulation requirement.

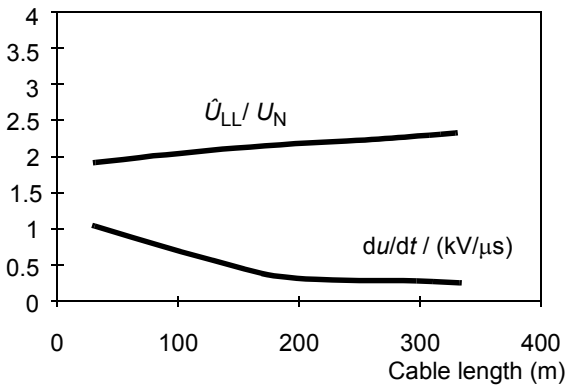
Example: Motor insulation requirement for a 400 V application must be selected as if the drive were supplied with 480 V.

Note 8: Calculating the rise time and the peak line-to-line voltage

The peak line-to-line voltage at the motor terminals generated by the drive as well as the voltage rise time depend on the cable length. The requirements for the motor insulation system given in the table are "worst case" requirements covering the drive installations with 30 metre and longer cables. The rise time can be calculated as follows: $\triangle t = 0.8 \cdot \hat{U}_{LL}/(du/dt)$. Read $\hat{U}_{LL}$ and du/dt from the diagrams below.



Without du/dt Filter



With du/dt Filter

Permanent magnet synchronous motor

Only one permanent magnet motor can be connected to the inverter output.

Install a safety switch between a permanent magnet synchronous motor and the motor cable. The switch is needed to isolate the motor during any maintenance work in the drive.

Wire the position information of the safety switch to the drive. Before starting any maintenance work on the drive, the safety switch must be opened, and the open position acknowledged by the drive application program.

Thermal overload and short-circuit protection

The drive protects itself and the input and motor cables against thermal overload when the cables are dimensioned according to the nominal current of the drive. No additional thermal protection devices are needed.

WARNING! If the drive is connected to multiple motors, a separate thermal overload switch or a circuit breaker must be used for protecting each cable and motor. These devices may require a separate fuse to cut off the short-circuit current.

The drive protects the motor cable and the motor in a short-circuit situation when the motor cable is dimensioned according to the nominal current of the drive.

Fuses

Fuses are needed to protect the supply section and the inverter of the drive in case of an internal short-circuit. The ACS800-17 is equipped with internal input fuses introduced in chapter *Technical data*. If a fuse is blown, it must be replaced with a similar ultrarapid fuse.

WARNING! Circuit breakers are not capable of providing sufficient protection because they are inherently slower than fuses. Always use fuses with circuit breakers.

Earth fault (Ground fault) protection

Both the supply unit and the inverter unit are equipped with an internal earth fault protective function to protect the drive against earth faults in the motor and the motor cable. (This is not a personal safety or a fire protection feature.) Both earth fault protective functions can be disabled; refer to *User's Manual* of the supply unit and the *Firmware Manual* of the drive application program respectively.

See the *ACS800 Ordering Information* (code: 64556568 [English], available on request) for other available earth fault protection options.

The EMC filter (if present) includes capacitors connected between the main circuit and the frame. These capacitors and long motor cables increase the earth leakage current and may cause fault current circuit breakers to function.

Emergency stop devices

For safety reasons, install the emergency stop devices at each operator control station and at other operating stations where emergency stop may be needed. Pressing the stop key (⏹) on the control panel of the drive, or turning the operating switch of the drive from position “1” to “0” does not generate an emergency stop of the motor or separate the drive from dangerous potential.

An emergency stop function is optionally available for stopping and switching off the whole drive. Two modes are available: immediate removal of power (Category 0) and controlled emergency stop (Category 1).

Note: The emergency stop function must not be used for stopping the drive in normal use.

Immediate removal of power (Category 0)

After the emergency stop button is pushed, the power semiconductors of the inverter unit are blocked (coast stop) and the main contactor (or air circuit breaker) is opened immediately. No attention is paid to deceleration of the motor and the driven machinery.

Controlled emergency stop (Category 1)

The installer must make sure that the overriding control fulfils the requirements of EN 60204-1, category 1.

- Upon receiving the emergency stop signal, each inverter starts braking (ramp stop within torque limits) and acknowledges the reception of the signal by closing a relay output.
- After a pre-set delay, the main contactor (or air circuit breaker) is opened. The time delay should be set slightly longer than the inverter stop ramps to ensure controlled braking of all motors.
- In case the acknowledgement is not received from all inverters within 2 seconds, the main contactor (or air circuit breaker) is opened immediately.

Restarting after an emergency stop

After an emergency stop, the emergency stop button must be released and a reset performed before the main contactor (or air ciruit breaker) can be closed and the drive started.

Prevention of unexpected start

The drive can be equipped with an optional prevention of unexpected start function according to standards EN 292-1: 1991; EN 292-2: 1991 + A1, 1995; EN 954-1: 1996; EN 60204-1-1: 1992 + Corr. 1993; and EN 1037: 1995.

The function is achieved by disconnecting the control voltage to the power semiconductors of the inverters of the drive. Thus it is not possible for the power semiconductors to switch and generate the AC voltage needed to rotate the motor. In case of faulty main circuit components, the DC voltage from the busbars can be conducted to the motor but an AC motor cannot rotate without the field generated by an AC voltage.

The operator activates the prevention of unexpected start function using a switch mounted on a control desk. When the function is activated, the switch is opened, and an indicator lamp will light.

WARNING! The prevention of unexpected start function does not disconnect the voltage of the main and auxiliary circuits from the drive. Therefore maintenance work on electrical parts of the drive can only be carried out after isolating the drive system from the main supply.

Selecting the power cables

General rules

Dimension the mains (input power) and motor cables **according to local regulations**:

- The cable must be able to carry the drive load current. See chapter *Technical data* for the rated currents.
- The cable must be rated for at least 60 °C maximum permissible temperature of conductor in continuous use. For US, see *Additional US requirements.*
- The inductance and impedance of the PE conductor/cable (grounding wire) must be rated according to permissible touch voltage appearing under fault conditions (so that the fault point voltage will not rise excessively when an ground fault occurs).
- 600 VAC cable is accepted for up to 500 VAC. For 690 VAC rated equipment, the rated voltage between the conductors of the cable should be minimum 1 kV.

For drive frame size R5 and larger, or motors larger than 30 kW, symmetrical shielded motor cable must be used (figure below). A four-conductor system can be used up to frame size R4 with up to 30 kW motors, but shielded symmetrical motor cable is recommended.

A four-conductor system is allowed for input cabling, but shielded symmetrical cable is recommended. To operate as a protective conductor, the shield conductivity must be as follows when the protective conductor is made of the same metal as the phase conductors:

Cross-sectional area of the phase conductors **S (mm^2)**	**Minimum cross-sectional area of the corresponding protective conductor** **S_p (mm^2)**
$S \leq 16$	S
$16 < S \leq 36$	16
$35 < S$	S/2

Compared to a four-conductor system, the use of symmetrical shielded cable reduces electromagnetic emission of the whole drive system as well as motor bearing currents and wear.

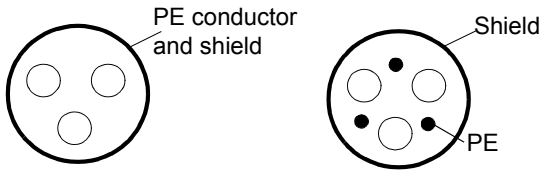
The motor cable and its PE pigtail (twisted screen) should be kept as short as possible in order to reduce electromagnetic emission as well as capacitive current.

Alternative power cable types

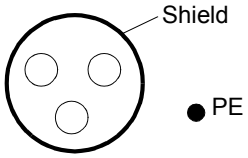
Power cable types that can be used with the drive are represented below.

Recommended

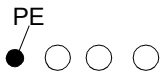
Symmetrical shielded cable: three phase conductors and a concentric or otherwise symmetrically constructed PE conductor, and a shield



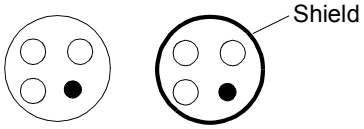
A separate PE conductor is required if the conductivity of the cable shield is < 50 % of the conductivity of the phase conductor.



A four-conductor system: three phase conductors and a protective conductor.



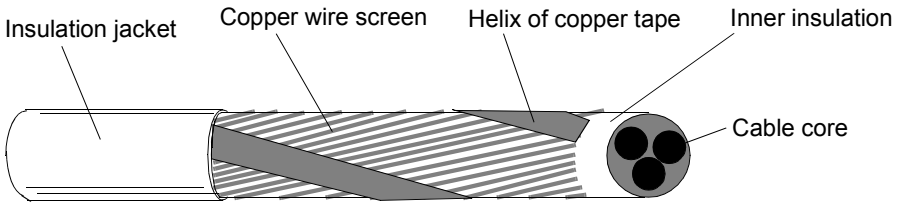
Not allowed for motor cables



Not allowed for motor cables with phase conductor cross section larger than 10 mm^2 (motors > 30 kW).

Motor cable shield

To effectively suppress radiated and conducted radio-frequency emissions, the shield conductivity must be at least 1/10 of the phase conductor conductivity. The requirements are easily met with a copper or aluminium shield. The minimum requirement of the motor cable shield of the drive is shown below. It consists of a concentric layer of copper wires with an open helix of copper tape. The better and tighter the shield, the lower the emission level and the bearing currents.



Additional US requirements

Type MC continuous corrugated aluminum armor cable with symmetrical grounds or shielded power cable must be used for the motor cables if metallic conduit is not used. For the North American market, 600 VAC cable is accepted for up to 500 VAC. 1000 VAC cable is required above 500 VAC (below 600 VAC). For drives rated over 100 amperes, the power cables must be rated for 75 °C (167 °F).

Conduit

Where conduits must be coupled together, bridge the joint with a ground conductor bonded to the conduit on each side of the joint. Bond the conduits also to the drive enclosure. Use separate conduits for input power, motor, brake resistors, and control wiring. Do not run motor wiring from more than one drive in the same conduit.

Armored cable / shielded power cable

The motor cables can be run in the same cable tray as other 460 V or 600 V power wiring. Control and signal cables must not be run in the same tray as power cables. Six conductor (3 phases and 3 ground) type MC continuous corrugated aluminum armor cable with symmetrical grounds is available from the following suppliers (trade names in parentheses):

- Anixter Wire & Cable (Philsheath)
- BICC General Corp (Philsheath)
- Rockbestos Co. (Gardex)
- Oaknite (CLX).

Shielded power cables are available from Belden, LAPPKABEL (ÖLFLEX) and Pirelli, among others.

Power factor compensation capacitors

Do not connect power factor compensation capacitors or surge absorbers to the motor cables (between the drive and the motor). They are not designed to be used with drives, and will degrade motor control accuracy. They can cause permanent damage to the drive or themselves due to the rapid changes in the drive output voltage.

If there are power factor compensation capacitors in parallel with the three phase input of the drive, ensure that the capacitors and the drive are not charged simultaneously to avoid voltage surges which might damage the unit.

Equipment connected to the motor cable

Installation of safety switches, contactors, connection boxes, etc.

To minimize the emission level when safety switches, contactors, connection boxes or similar equipment are installed in the motor cable (i.e. between the drive and the motor):

- EU: Install the equipment in a metal enclosure with 360 degrees grounding for the shields of both the incoming and outgoing cables, or in another way connect the shields of the cables together.
- US: Install the equipment in a metal enclosure in a way that the conduit or motor cable shielding runs consistently without breaks from the drive to the motor.

Bypass connection

WARNING! Never connect the supply power to the drive output terminals U2, V2 and W2. If frequent bypassing is required, employ mechanically connected switches or contactors. Mains (line) voltage applied to the output can result in permanent damage to the unit.

Before opening a contactor (DTC control mode selected)

Stop the drive and wait for the motor to stop before opening a contactor between the output of the drive and the motor when DTC control mode is selected. (See the *Firmware Manual* of the drive for the required parameter settings.) Otherwise, the contactor will be damaged.

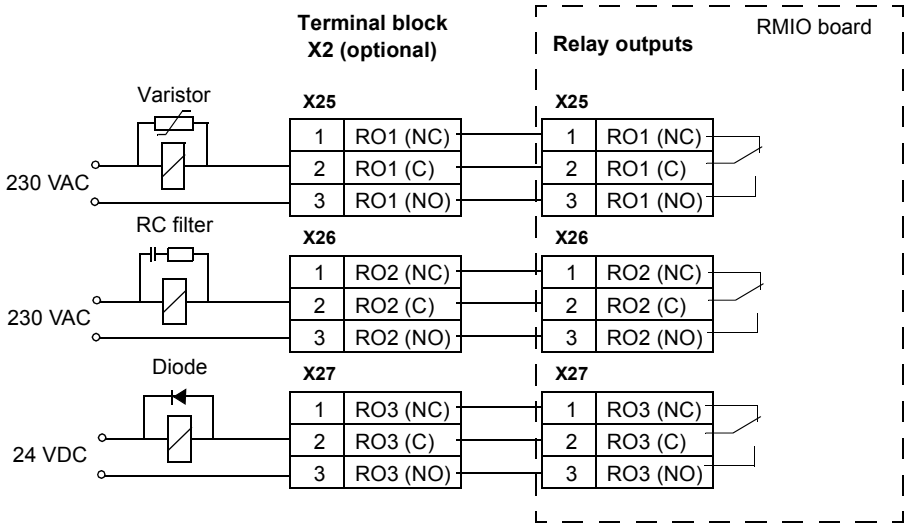
In scalar control, the contactor can be opened with the drive running.

Relay output contacts and inductive loads

Inductive loads (such as relays, contactors, motors) cause voltage transients when switched off.

The relay contacts of the RMIO board are protected with varistors (250 V) against overvoltage peaks. In spite of this, it is highly recommended to equip inductive loads with noise attenuating circuits (varistors, RC filters [AC] or diodes [DC]) in order to minimize the EMC emission at switch-off. If not suppressed, the disturbances may connect capacitively or inductively to other conductors in the control cable and form a risk of malfunction in other parts of the system.

Install the protective component as close to the inductive load as possible. Do not install the protective components at the terminal block.

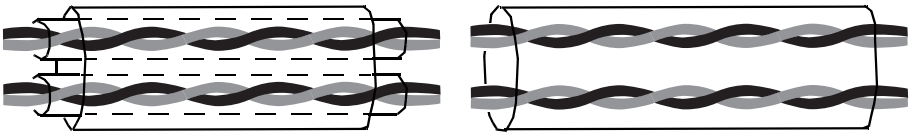


Selecting the control cables

All control cables must be shielded.

Use a double-shielded twisted pair cable (Figure a, e.g. JAMAK by NK Cables, Finland) for analogue signals. This type of cable is recommended for the pulse encoder signals also. Employ one individually shielded pair for each signal. Do not use common return for different analogue signals.

A double-shielded cable is the best alternative for low-voltage digital signals but single-shielded twisted multipair cable (Figure b) is also usable.



a
Double shielded twisted pair cable

b
Single shielded twisted multipair cable

Run analogue and digital signals in separate, shielded cables.

Relay-controlled signals, providing their voltage does not exceed 48 V, can be run in the same cables as digital input signals. It is recommended that the relay-controlled signals be run as twisted pairs.

Never mix 24 VDC and 115 / 230 VAC signals in the same cable.

Relay cable

The cable type with braided metallic screen (e.g. ÖLFLEX LAPPKABEL, Germany) has been tested and approved by ABB.

Control panel cable

In remote use, the cable connecting the control panel to the drive must not exceed 3 metres (10 ft). The cable type tested and approved by ABB is used in control panel option kits.

Coaxial cable (for use with Advant Controllers AC 80/AC 800)

- 75 ohm
- RG59, diameter 7 mm or RG11, diameter 11 mm
- Maximum cable length: 300 m (1000 ft)

Connection of a motor temperature sensor to the drive I/O

WARNING! IEC 60664 requires double or reinforced insulation between live parts and the surface of accessible parts of electrical equipment which are either non-conductive or conductive but not connected to the protective earth.

To fulfil this requirement, the connection of a thermistor (and other similar components) to the digital inputs of the drive can be implemented in three alternate ways:

1. There is double or reinforced insulation between the thermistor and live parts of the motor.
2. Circuits connected to all digital and analogue inputs of the drive are protected against contact and insulated with basic insulation (the same voltage level as the drive main circuit) from other low voltage circuits.
3. An external thermistor relay is used. The insulation of the relay must be rated for the same voltage level as the main circuit of the drive. For connection, see the *Firmware Manual*.

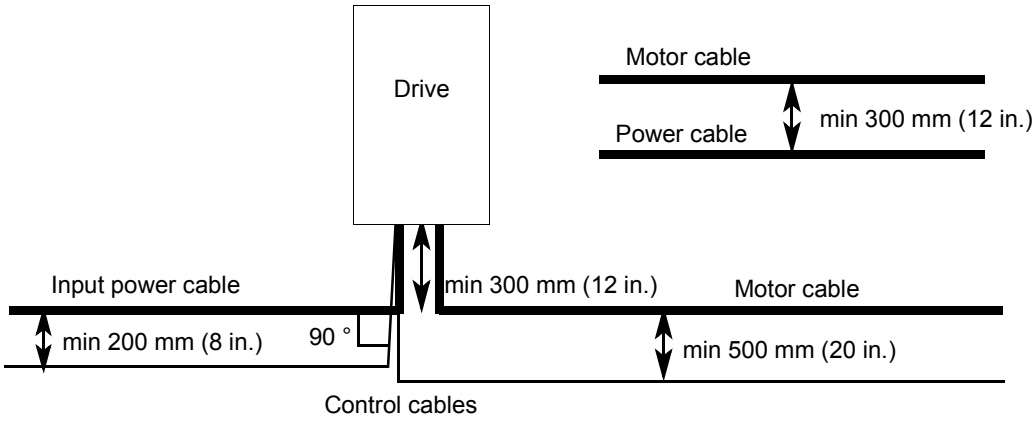
Routing the cables

Route the motor cable away from other cable routes. Motor cables of several drives can be run in parallel installed next to each other. It is recommended that the motor cable, input power cable and control cables be installed on separate trays. Avoid long parallel runs of motor cables with other cables in order to decrease electromagnetic interference caused by the rapid changes in the drive output voltage.

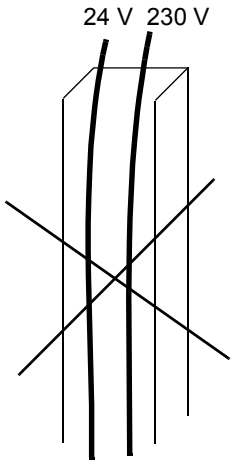
Where control cables must cross power cables make sure they are arranged at an angle as near to 90 degrees as possible. Do not run extra cables through the drive.

The cable trays must have good electrical bonding to each other and to the grounding electrodes. Aluminium tray systems can be used to improve local equalizing of potential.

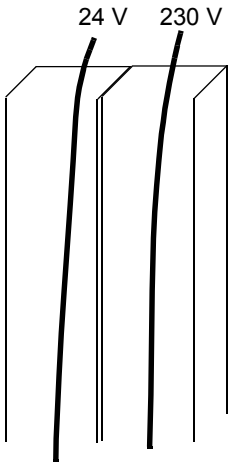
A diagram of the cable routing is below.



Control cable ducts



Not allowed unless the 24 V cable is insulated for 230 V or insulated with an insulation sleeving for 230 V.



Lead 24 V and 230 V control cables in separate ducts inside the cabinet.

Electrical installation

WARNING! Only qualified electricians are allowed to carry out the work described in this chapter. Follow the *Safety instructions* on the first pages of this manual. Ignoring the safety instructions can cause injury or death.

What this chapter contains

This chapter describes the electrical installation of the drive.

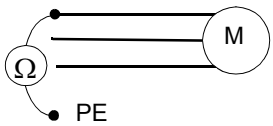
Insulation checks

Every drive has been tested for insulation between main circuit and cabinet (2500 V rms 50 Hz for 1 minute) at the factory. Therefore there is no need to check the insulation of the unit again. When checking the insulation of the assembly, proceed in the following manner:

WARNING! Insulation checks must be performed before connecting the drive to the mains. Before proceeding with the insulation resistance measurements make sure that the drive is disconnected from the mains.

Motor and motor cable

- Check that the motor cable is disconnected from the drive output terminals U2, V2 and W2.
- Measure the insulation resistances of motor cable and the motor between each phase and Protective Earth using a measuring voltage of 1 kV d.c. The insulation resistance must be higher than 1 MΩ.



$R \geq 1\ M\Omega$

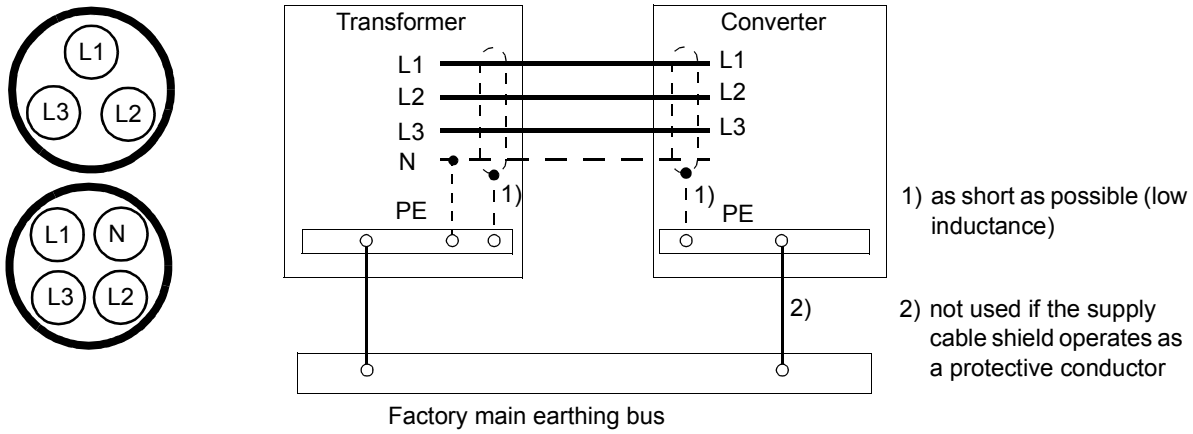
Input power cable wiring diagrams

This section describes the input power cable connections of the drive. The following *Motor cable wiring diagrams* section provides some basic instructions for the routing and mechanical connection of cables. The mechanical cable connections are basically the same, whether for the incoming supply or an inverter; different are the cabinet dimensions and the location of the terminals for the cables. The cabling direction may also vary (top or bottom).

The N conductor is not normally used with drives although it is visible in the following diagrams.

Low power supply

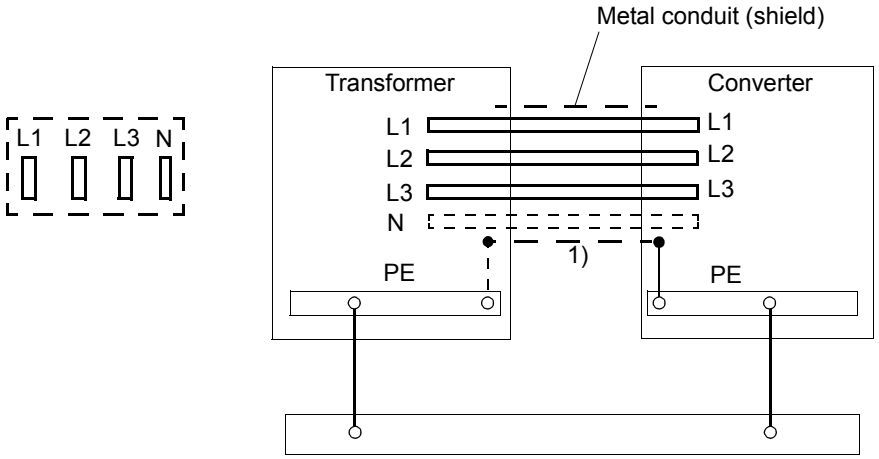
A low current (< 300 A) cable connection when one cable is sufficient is represented below.



High power supply

Busbar connection

A high current (> 300 A) busbar connection is represented below.

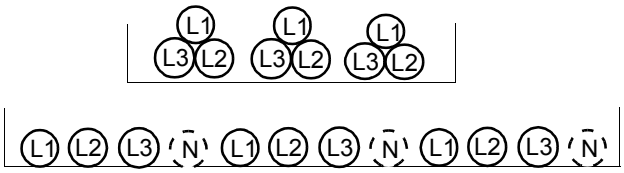


1) Connect the metal conduit of the busbar system (or the metal of the bus duct) to PE at either one end or both ends.

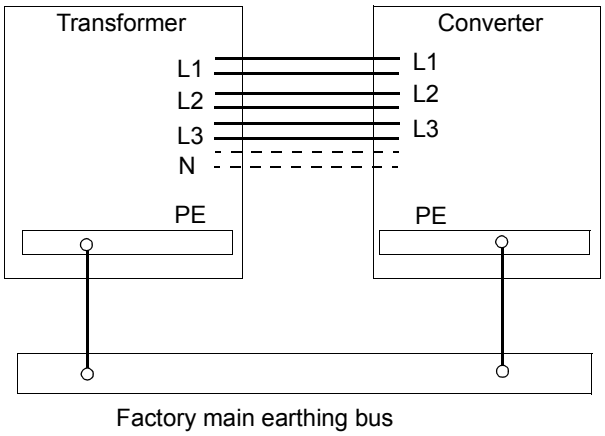
Note: The paint should be removed to allow a good connection to the cabinet frames throughout the whole perimeter of the metal conduit (or a bus duct). The metal conduit (or the bus duct metal) should be electrically continuous throughout its complete length.

Cable bus system

The connection of a high current (> 300 A) cable bus system that consists of several cables is represented below. In this system, less conductor material is needed due to better cooling of separate conductors.



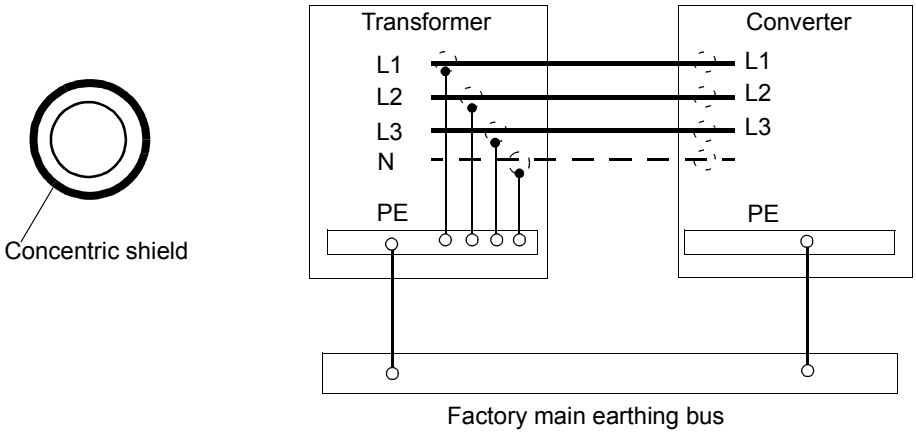
It is recommended to arrange the cables as shown alongside to achieve a current distribution as accurate as possible. Air between cables is required for cooling.



Note: Current derating of the cables is required when installing the cables in a cable tray. This derating factor must be taken into account as per the local electrical safety codes.

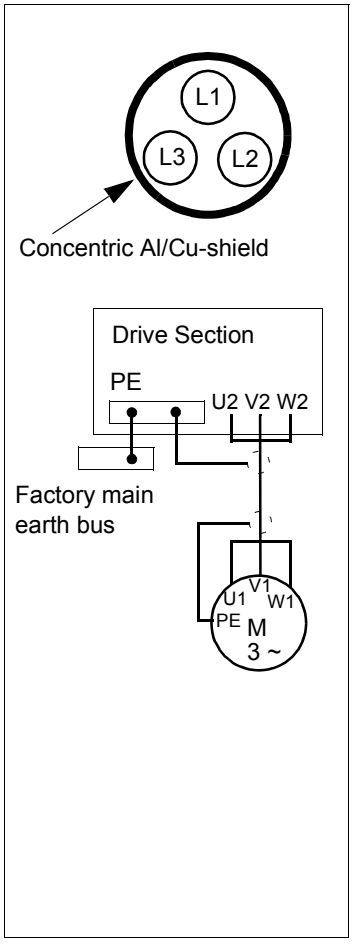
Single-core cables with concentric protective shields

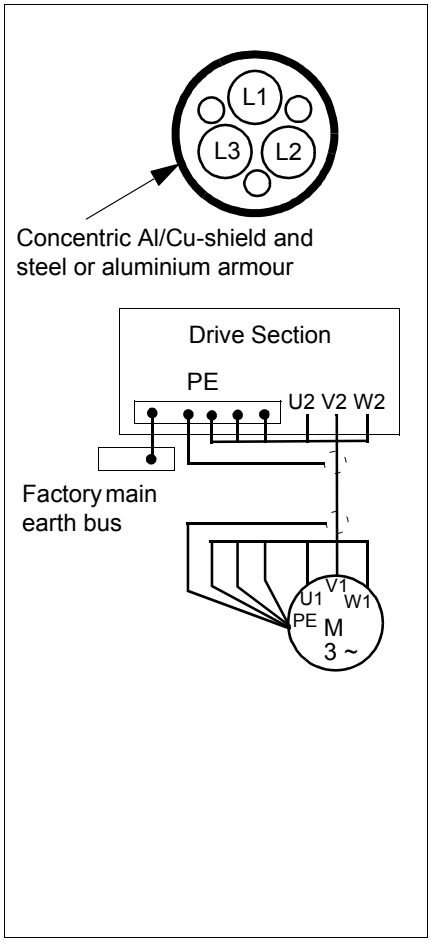
When single-core cables equipped with concentric protective shields (metal) are used, the phase current will induce voltage to the cable shield. If the shields are connected to each other at both ends of the cable, current will flow in the cable shield. In order to prevent this and to ensure personal safety, the cable shield must be connected only to PE at the transformer side and insulated on the converter side. The connection is represented below.

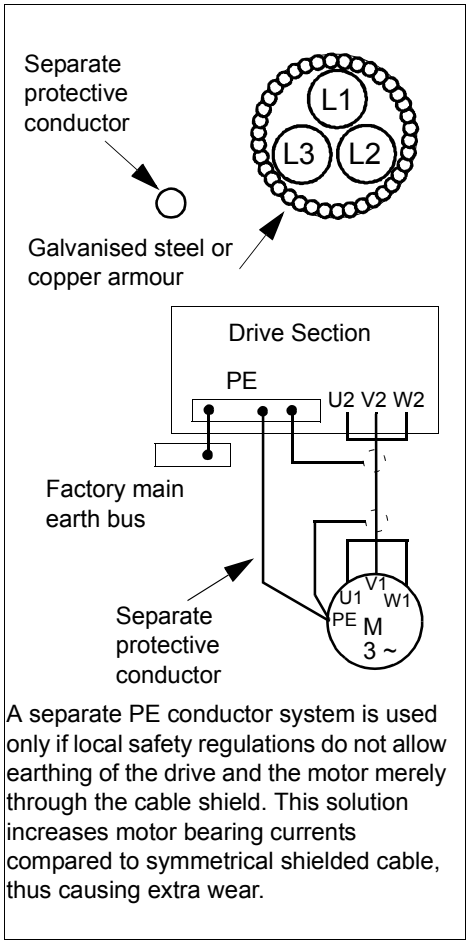


Motor cable wiring diagrams

Motor cable connections for different cable types are represented below. For minimum radio frequency interference (RFI) at the motor end, earth the cable shield 360 degrees at the lead-through or earth the cable by twisting the shield (flattened width ≥ 1/5 · length).



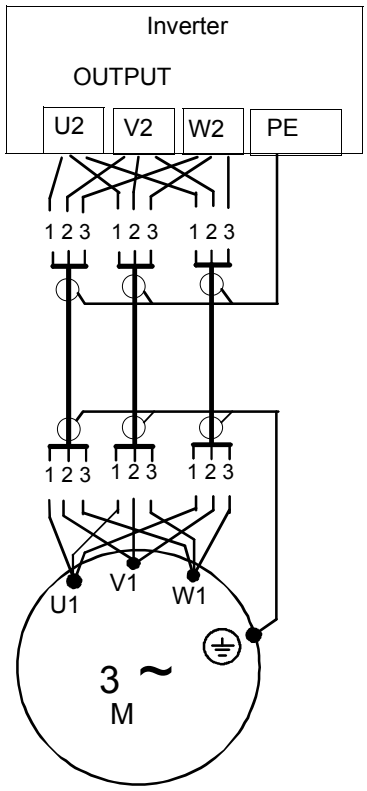




A separate PE conductor system is used only if local safety regulations do not allow earthing of the drive and the motor merely through the cable shield. This solution increases motor bearing currents compared to symmetrical shielded cable, thus causing extra wear.

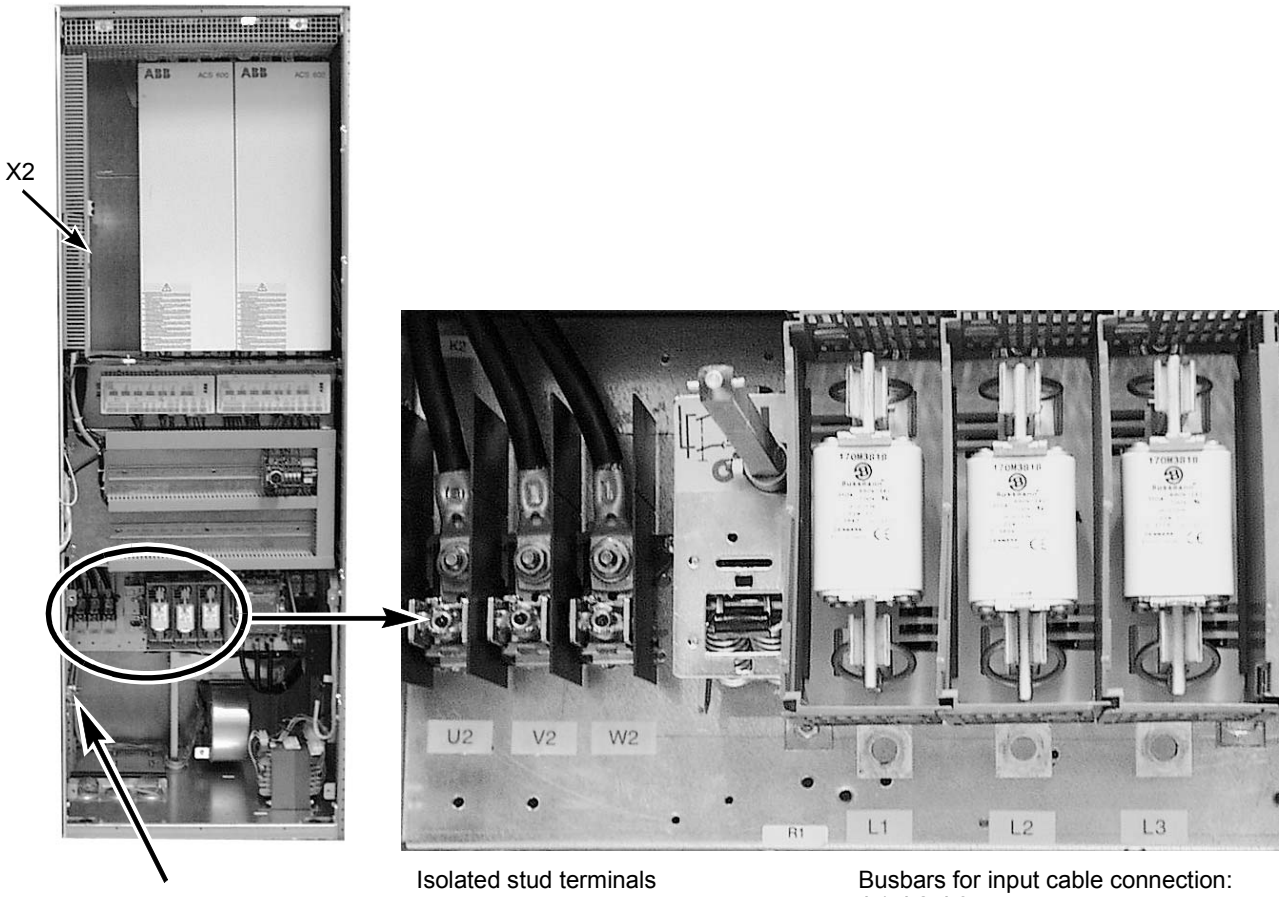
Single inverters

Motor cable connections with parallel symmetrical cables are represented below.



Location of power cable terminals (R6i, R7i)

The cable connections of a bottom entry unit of frame size R7i are represented below. In frame size R6i, the terminals are located similarly.



PE terminal of the cabinet

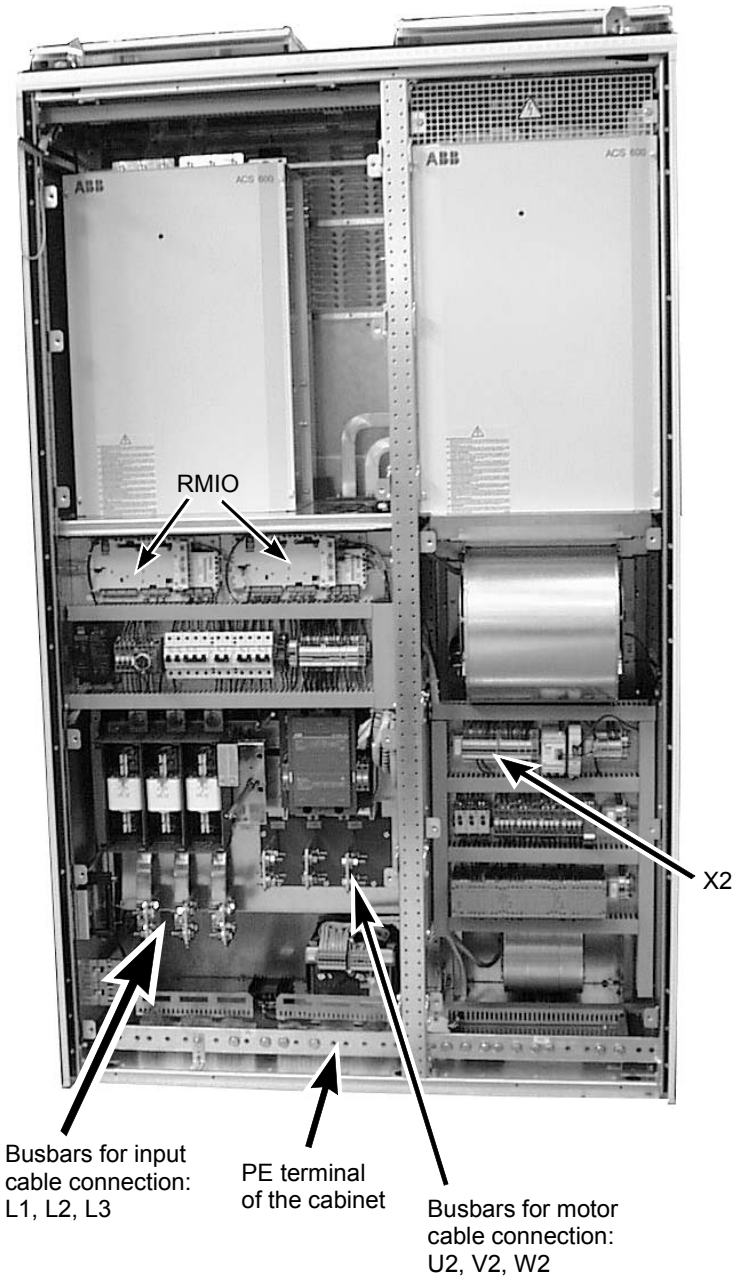
Isolated stud terminals for motor cable connection: U2, V2, W2.

Busbars for input cable connection: L1, L2, L3.

Location of power cable terminals (R8i, R9i)

The cable connections of a bottom entry unit of frame size R9i are represented below. In frame size R8i, the terminals are located similarly.

Bottom entry unit

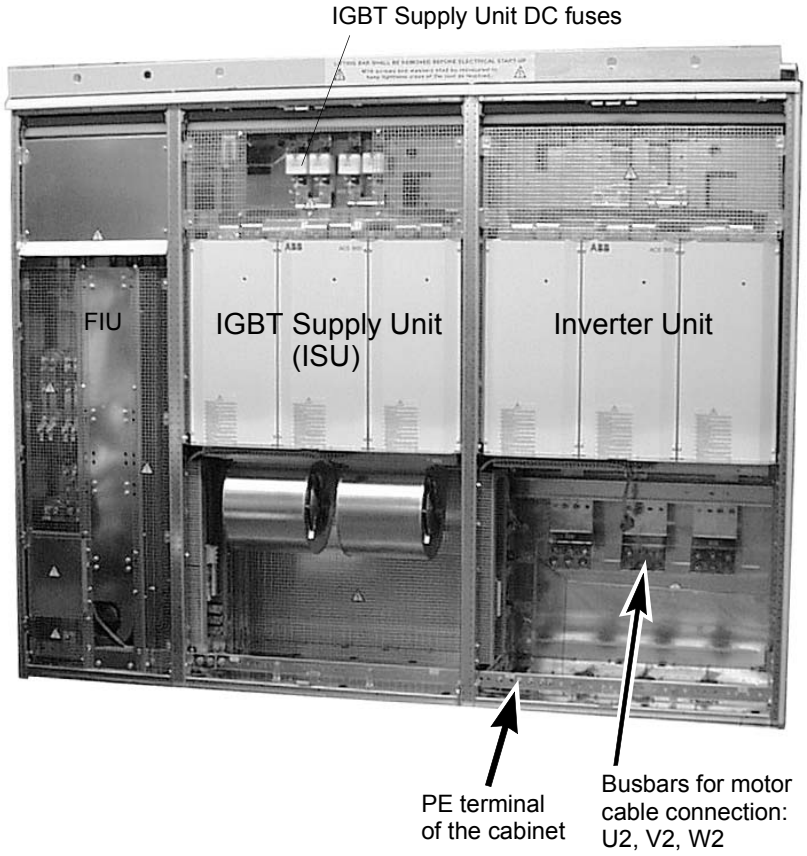

RMIO
X2
Busbars for input cable connection: L1, L2, L3
PE terminal of the cabinet
Busbars for motor cable connection: U2, V2, W2

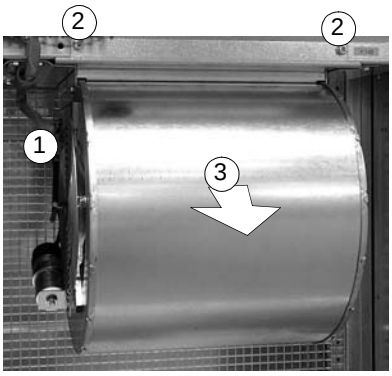
Top entry unit

Location of motor cable terminals (R11i and R12i bottom entry)

The cable connections of a bottom entry unit of frame size R11i are represented below. In frame size R12i, the terminals are located similarly. The input cables are lead via the Incoming Unit. To gain access to the motor cable terminals, remove the cooling fans as follows:

4. Disconnect the cables (detachable terminal).
5. Undo the fastening screws.
6. Lift the fan from the cabinet.
7. Remove the shrouds.


IGBT Supply Unit DC fuses
FIU
IGBT Supply Unit (ISU)
Inverter Unit
PE terminal of the cabinet
Busbars for motor cable connection: U2, V2, W2

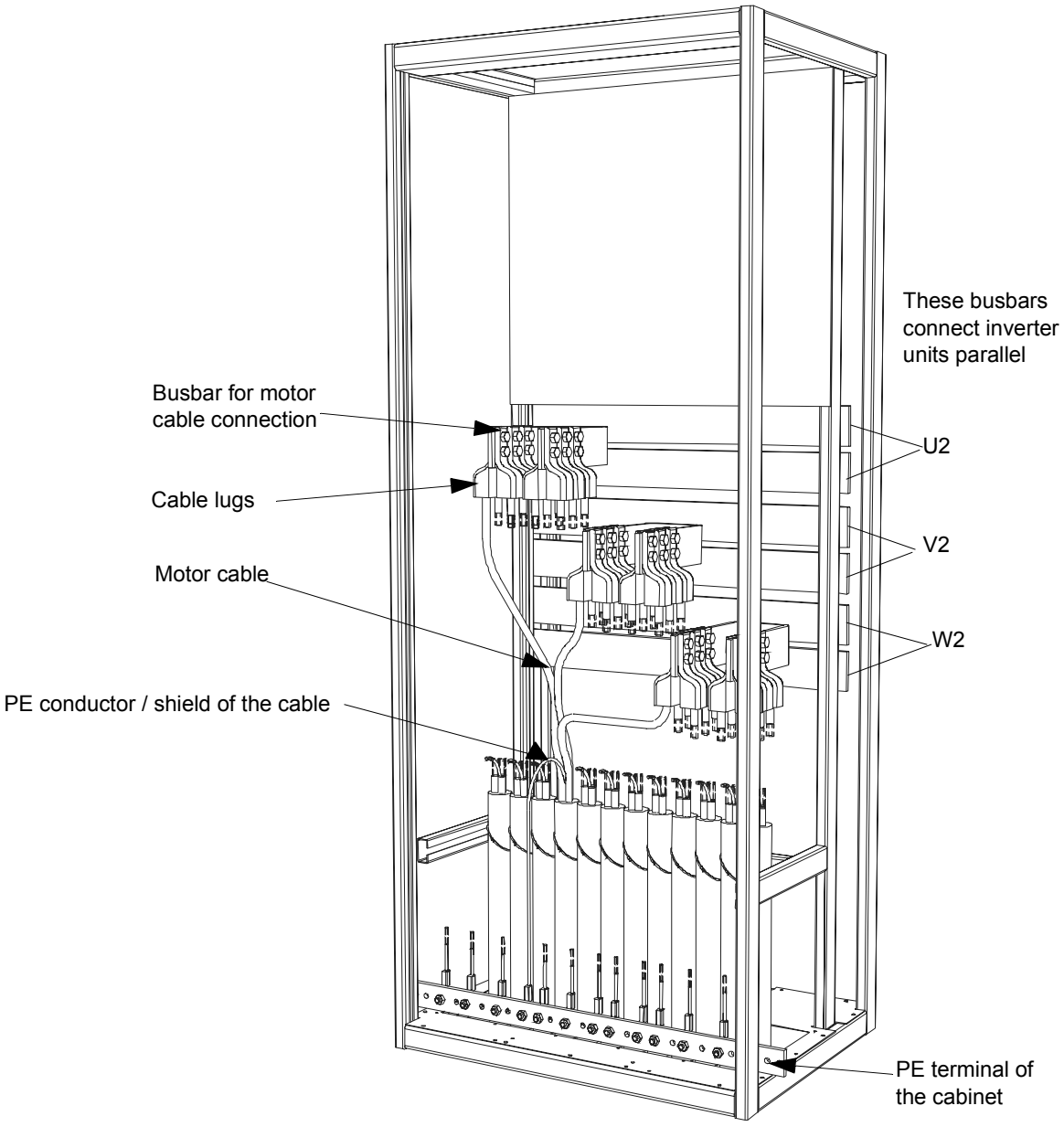


Location of motor cable terminals (R11i and R12i top exit)

This cubicle is used for

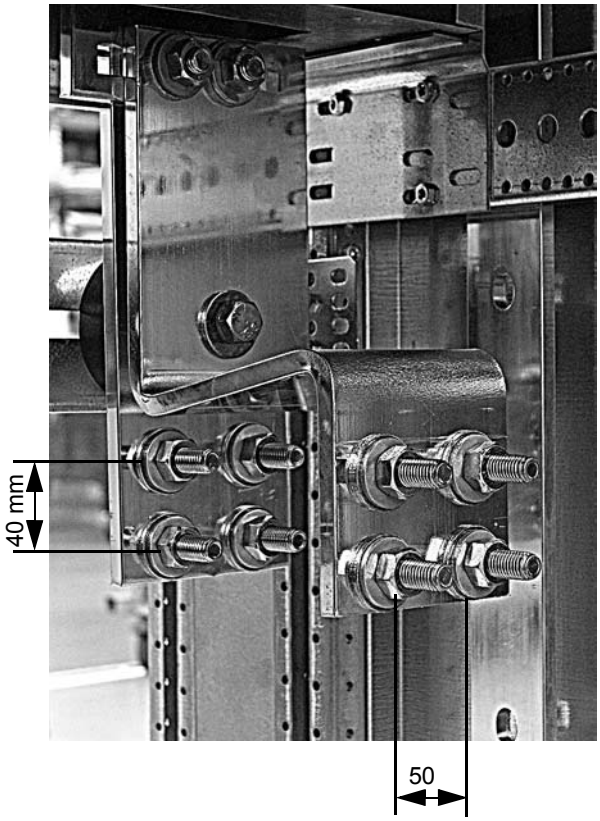
- motor cable entry and exit through the top of the cabinet

Cable entry from the bottom is shown below. The top entry is accomplished in the same way except that cables are entering or exiting the cabinet from the top.



About power cable busbars and use of cable lugs

A view of power cable busbars of large drive units is shown below. If necessary, the same screw can be used for connecting two cable lugs (on both sides of the busbar). Cable lugs with one or two holes can be used. Always use a torque wrench for tightening the busbar connections. **Note:** In inverter modules R6i and R7i, only one cable lug can be connected to a busbar screw.

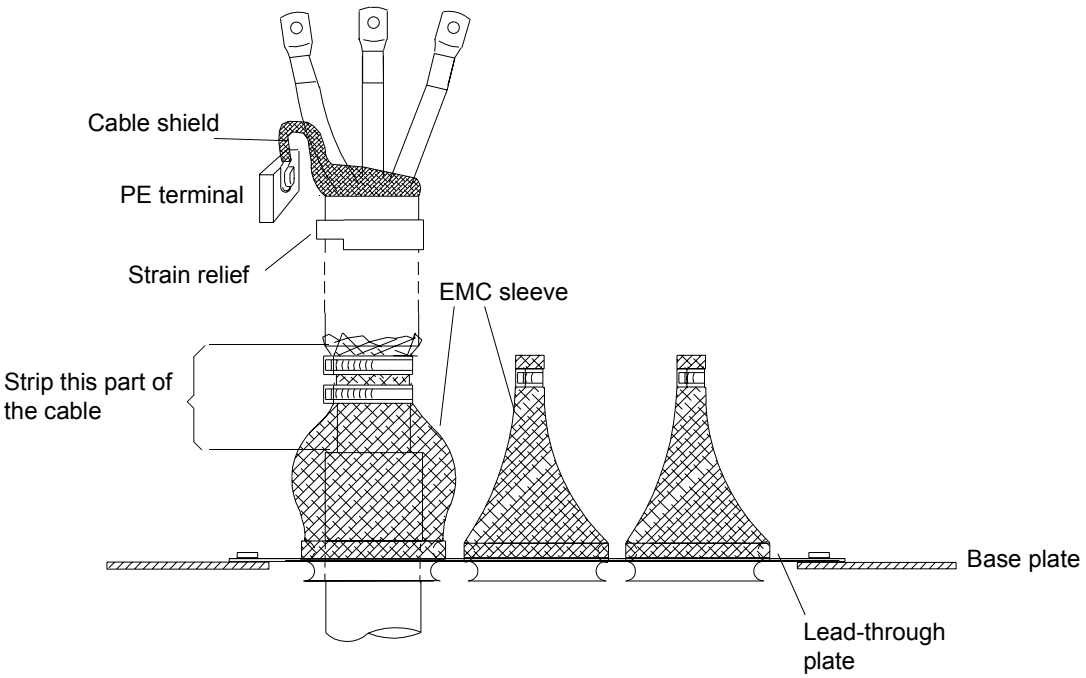


Use of conductive sleeves of power cable lead-throughs

Conductive sleeves are supplied by ABB as an option to provide 360° high-frequency earthing for motor cables. Follow these instructions:

- If fire insulation is used, make an opening to the mineral wool sheet according to the diameter of the cable.
- Pull the cable into the cabinet through the conductive sleeve.
- If a rubber grommet is used, slide it onto the cable.
- Connect phase conductors to terminals.
- Twist the shield wires of the cable together and connect them to earth terminal or PE busbar.
- Peel off 3 to 5 cm of the outer insulation of the cable above the entry plate for the 360° high-frequency earthing.
- Fasten the conductive sleeve to the cable shield with a cable tie.
- Seal the slot between the cable and mineral wool sheet (if used) with sealing compound (e.g. CSD-F, ABB brand name DXXT-11, code 35080082).
- Tie up the unused conductive sleeves with cable ties.

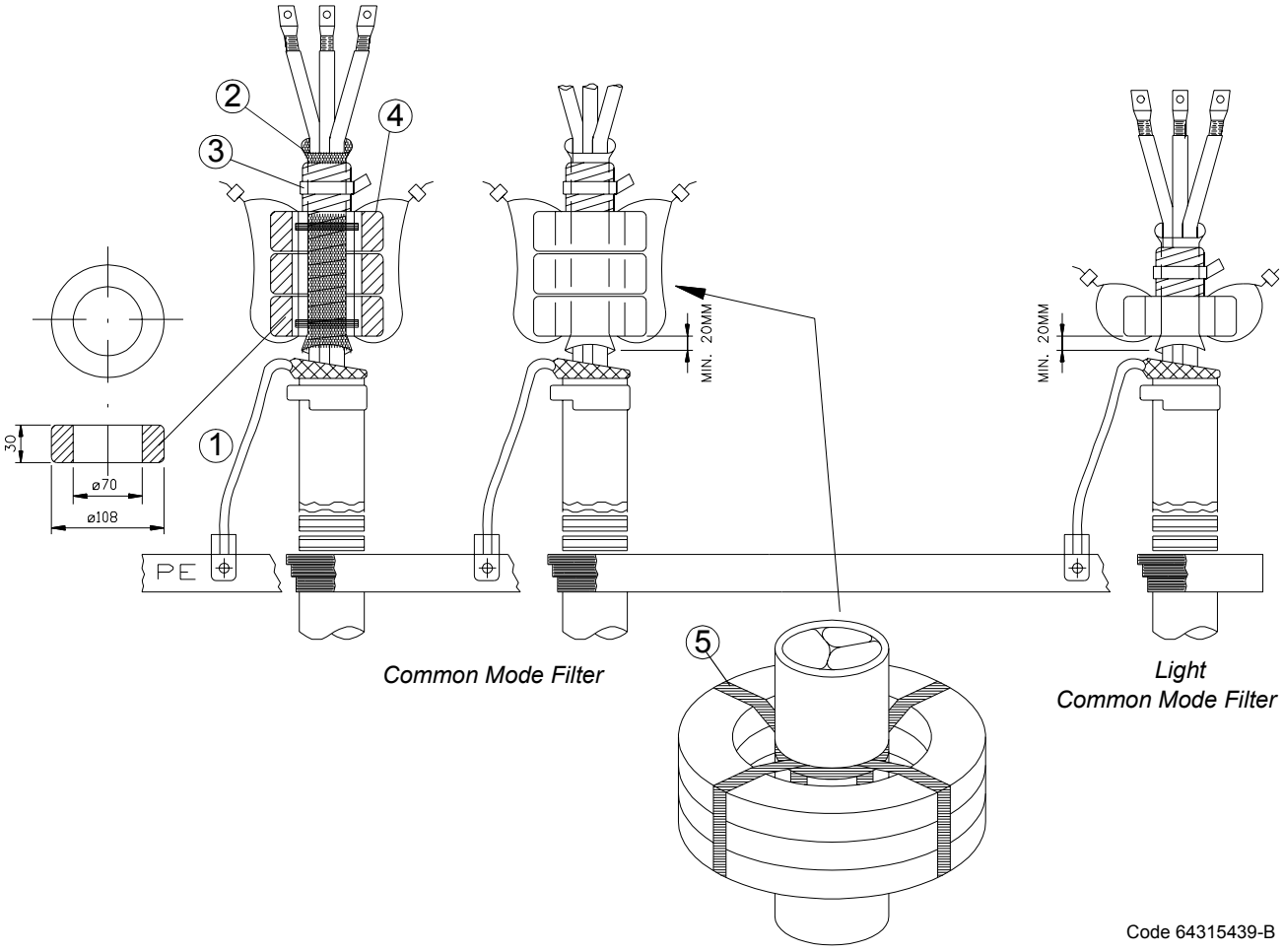
Cable entry from below for power cables of drive (IP 21 and IP 22) is shown below. Tighten the EMC sleeve on the stripped part of the cable with cable ties. *For IP 54 units, add a rubber grommet on the cable under the lead-through plate.*



Use of common mode filters on the motor cable

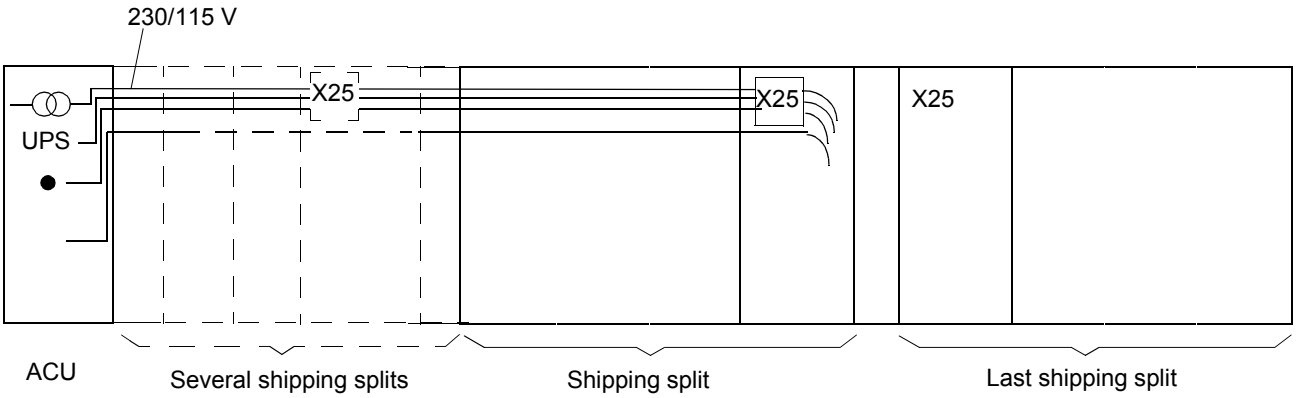
If common mode filter or light common mode filter is required (see *Planning the electrical installation* / *Checking the compatibility of the motor / Requirements table)*, lead the motor cable phase conductors through the toroidal cores as follows:

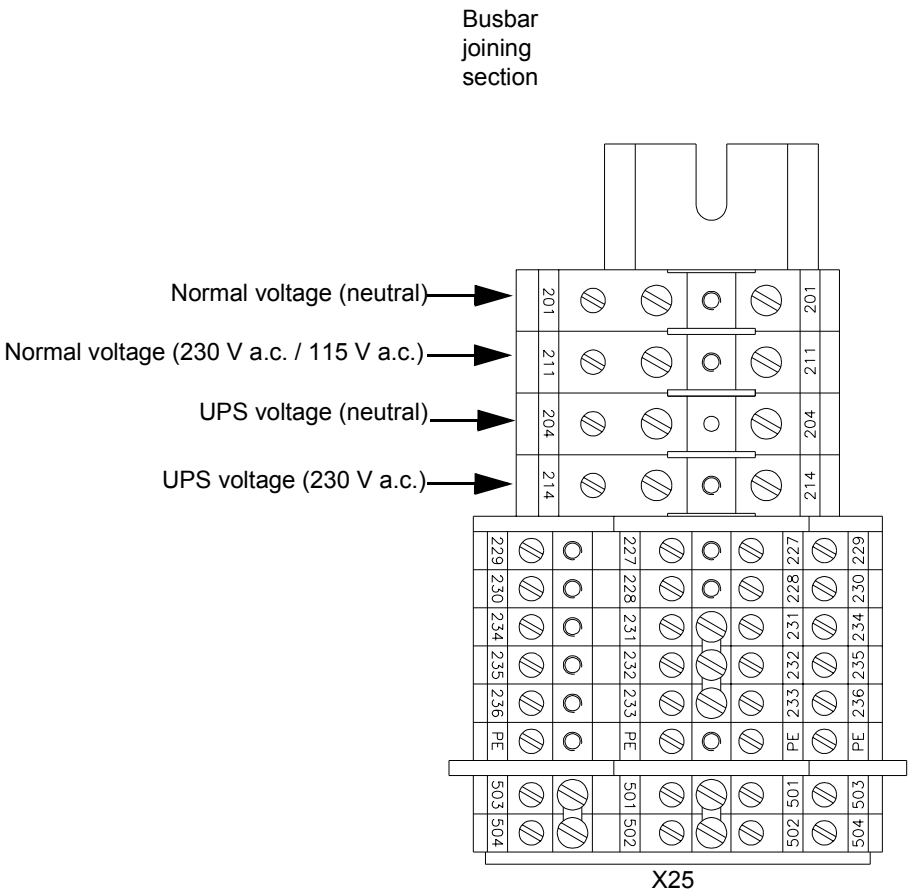
- Connect the twisted cable shield to the PE terminal.
- Wrap the phase conductors together with the silicon rubber tape delivered with the toroidal cores to provide thermal insulation for the conductor insulator. Cover the part of the cable which will be left inside the core(s) + 20 mm below. Approximately 1.5 metres of tape is needed per cable. Each turn must overlap the previous turn by half the width of the tape.
- Bind the conductors tightly with non-conductive electrical tape and a heat-resisting non-metallic cable tie in order to prevent conductor insulation damage caused by the core edges.
- Slide the core(s) onto the taped part of the phase conductors.
- Bind the cores together and onto the taped part of the phase conductors with heat-resisting non-metallic cable ties.



Control cable connections at shipping split joints

Some control wires are chained through the shipping splits. 230/115 V voltage transformer, uninterrupted power supply (UPS) and emergency stop wires are chained via terminal blocks X25 at the upper left hand corner of the fields next to the busbar joining sections. Connect the loose wires to the next X25 terminal block. Connect the loose wires not coming from X25 to the destinations marked on the wire ends. **Ensure that no unconnected wire ends are left which will be powered when the supply voltage is switched on**.





External control cable connections

Connect the control cables to the appropriate terminals on terminal block X2 or 2TB (see *Motor control and I/O board (RMIO)*), or other options on the DIN rail. Connect the twisted shield (as short as possible) to the earthing terminal ⏚ .

Supply unit control connections

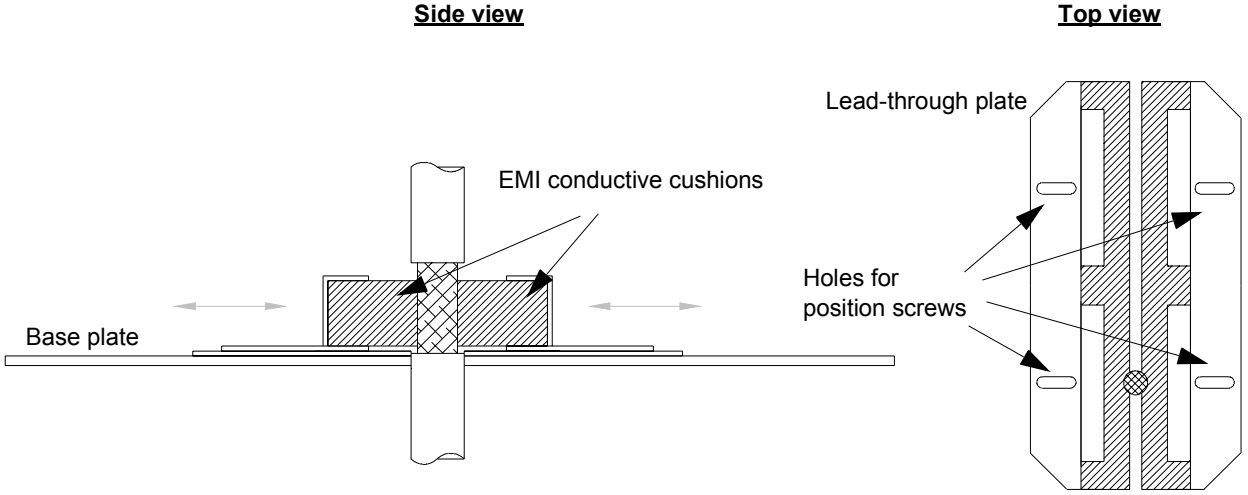
The supply unit is controlled using the local control devices mounted on the cabinet door. No external control connections by the user are needed. However, the user can connect certain external devices to the supply module. It is possible to:

- control the supply unit through the remote control inputs (On, Start, Reset, External fault)
- halt the supply unit by an external emergency stop button (if the unit is equipped with a local emergency stop button)
- read supply unit's status information through the relay outputs (Fault, Running, Earth fault, emergency stop)

Refer to the circuit diagrams delivered with the drive for the connection terminals for the external control devices. For additional information on the control connections see the *ACA631/633 Cabinet-installed Diode Supply Unit (DSU) User's Manual* (Code: 64735501 [English]), available through ABB representatives.

EMC earthing at the cable entry

360° high frequency earthing of the control cable shield at the cable entry is available as an option from ABB (figure below).



Special for top entry

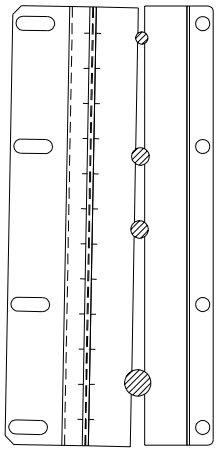
When each cable has its own rubber grommet, sufficient IP and EMC protection can be achieved. However, if very many control cables come to one cabinet, plan the installation beforehand as follows:

- Make a list of the cables coming to the cabinet.
- Sort the cables going to the left into one group and the cables going to the right into another group to avoid unnecessary crossing of cables inside the cabinet.
- Sort the cables in each group according to size.
- Group the cables for each grommet as follows:

Cable diameter in mm	Max. number of cables per grommet
≤ 13	4
≤ 17	3
< 25	2
≥ 25	1

- Divide the bunches so that cables will be arranged according to size between the *EMI conductive cushions*.

View from below



Thinnest cable

Thickest cable

Bottom and top entry

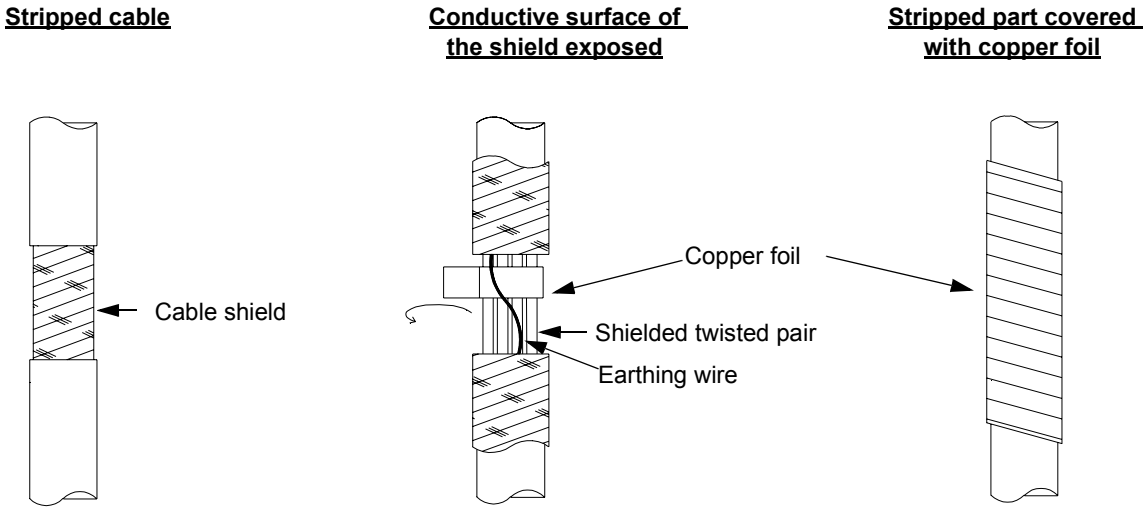
Proceed as follows:

- Loosen the *lead-through plate position screws*. Pull the two parts apart.
- Bottom entry
  Lead the cable inside the cabinet through the *EMI conductive cushions.*
  Top entry
  Lead the cable inside the cabinet through the grommet and the *EMI conductive cushions.* If you have several cables, bunch them together at the grommet, but ensure that each cable has a proper contact to the cushions on both sides.
- Strip off the cable plastic sheath above the *base plate* (just enough to ensure proper connection of the bare shield and the *EMI conductive cushions*).
- Earth the shield between the *EMI conductive cushions*:

If the outer surface of the shield is conductive:

- Push the two parts of the *lead-through plate* together so that the *EMI conductive cushions* press tightly round the bare shield.

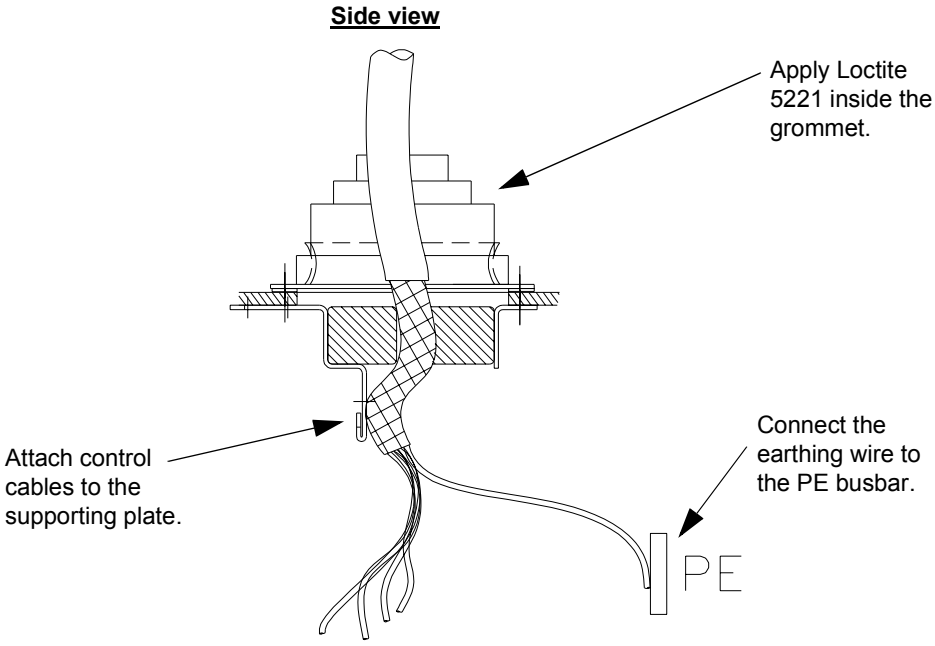
If the outer surface of the shield is covered with non-conductive material:



- Cut the shield at the midpoint of the bare part. Be careful not to cut the conductors.
- Turn the shield inside out to expose its conductive surface.
- Cover the turned shield and the stripped cable with copper foil to keep the shielding continuous. **Note:** The earthing wire (if present) must not be cut.
- Push the two parts of the *lead-through plate* together so that the *EMI conductive cushions* press tightly round the foil-covered shield.

- Lock the two parts of the *lead-through plate* by tightening the *positioning screws*.

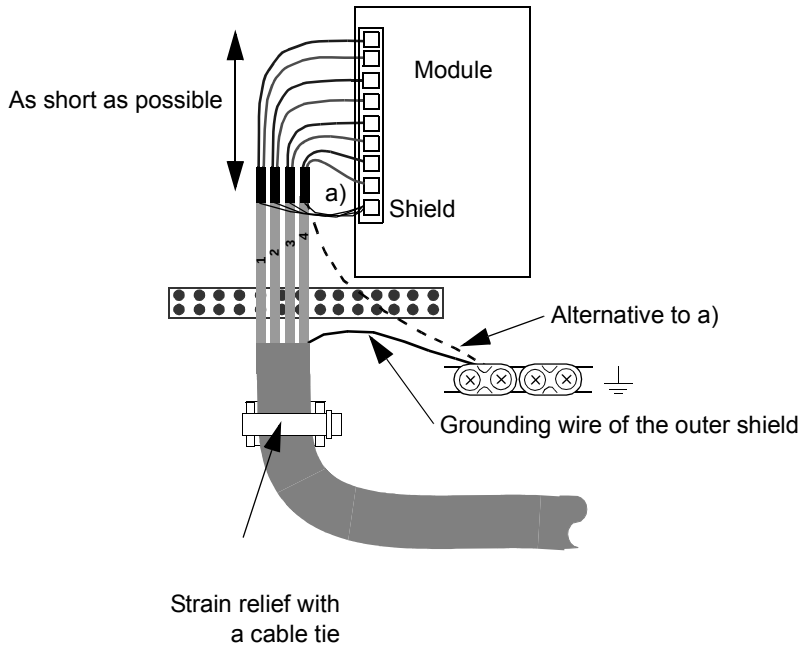
- Top entry: If more than one cable go through a grommet, the grommet must be sealed by Loctite 5221 (catalogue number 25551).


Side view
Apply Loctite 5221 inside the grommet.
Attach control cables to the supporting plate.
Connect the earthing wire to the PE busbar.
PE

Installation of optional modules and PC

The optional module (such as fieldbus adapter, I/O extension module and the pulse encoder interface) is inserted in the optional module slot of the RMIO board and fixed with two screws. See the appropriate optional module manual for cable connections.

Cabling of I/O and fieldbus modules

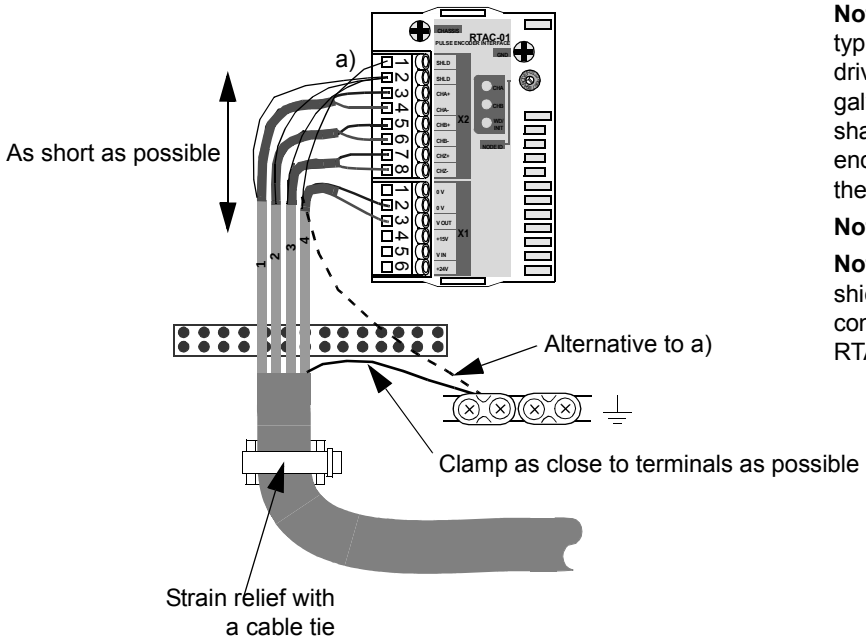


Pulse encoder installation

See *Pulse Encoder Interface Module RTAC-0x User's Manual* [3AFE 64486853 (English)] for the pulse encoder insulation requirements and connections.

The pulse encoder shall be insulated from the motor stator or rotor in order to prevent currents from finding their way out from the drive shaft through the encoder with resulting damage to the bearings in both the motor and the encoder.

Pulse encoder module cabling



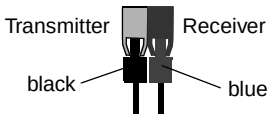
Note1: If the encoder is of unisolated type, ground the encoder cable at the drive end only. If the encoder is galvanically isolated from the motor shaft and the stator frame, ground the encoder cable shield at the drive and the encoder end.

Note 2: Twist the pair cable wires.

Note 3: The grounding wire of the outer shield of the cable can alternatively be connected to the SHLD terminal of the RTAC module.

Fibre optic link

A DDCS fibre optic link is provided via the RDCO optional module for PC tools, master/follower link, NDIO, NTAC, NAIO, AIMA I/O module adapter and fieldbus adapter modules of type Nxxx. See *RDCO User's Manual* [3AFE 64492209 (English)] for the connections. Observe colour coding when installing fibre optic cables. Blue connectors go to dark grey terminals, and black connectors to light grey terminals:



When installing multiple modules on the same channel, connect them in a ring.

Motor control and I/O board (RMIO)

What this chapter contains

This chapter shows

- external control connections to the RMIO board for the the ACS 800 Standard Application Program (Factory Macro)
- specifications of the inputs and outputs of the board.

To which products this chapter applies

This chapter applies to ACS800 units which employ the RMIO board.

Note for terminal blocks X2 and 2TB

The terminals of the RMIO board are wired to optional terminal block X2 or 2TB (if present).

Note for external power supply

WARNING! If the RMIO board is supplied from an external power source, the loose end of the cable removed from the RMIO board terminal must be secured mechanically to a location where it cannot come into contact with electrical parts. If the screw terminal plug of the cable is removed, the wire ends must be individually insulated.

External control connections (non-US)

External control cable connections to the RMIO board for the ACS 800 Standard Application Program (Factory Macro) are shown below. For external control connections of other application macros and programs, see the appropriate *Firmware Manual*.

Terminal block size

X20 to X27: cables 0.3 to 3.3 mm^2 (22 to 12 AWG)

X2: 0.5 to 2.5 mm^2

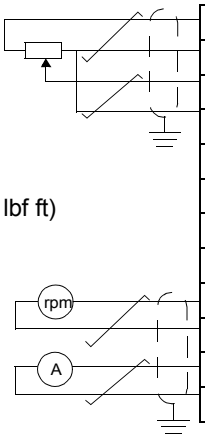
(22 to 14 AWG)

Tightening torque

X20 to X27: 0.2 to 0.4 Nm

(0.2 to 0.3 lbf ft)

X2: 0.4 to 0.6 Nm (0.3 to 0.4 lbf ft)



X2		X20		
35	- - - -	1	VREF-	Reference voltage -10 VDC, 1 kohm ≤ R_L ≤ 10 kohm
36	- - - -	2	AGND	
X21				
1	- - - -	1	VREF+	Reference voltage 10 VDC, 1 kohm ≤ R_L ≤ 10 kohm
2	- - - -	2	AGND	
3	- - - -	3	AI1+	Speed reference 0(2) ... 10 V, R_{in} > 200 kohm
4	- - - -	4	AI1-	
5	- - - -	5	AI2+	By default, not in use. 0(4) ... 20 mA, R_{in} = 100 ohm
6	- - - -	6	AI2-	
7	- - - -	7	AI3+	By default, not in use. 0(4) ... 20 mA, R_{in} = 100 ohm
8	- - - -	8	AI3-	
9	- - - -	9	AO1+	Motor speed 0(4)...20 mA ≙ 0...motor nom. speed, R_L ≤ 700 ohm
10	- - - -	10	AO1-	
11	- - - -	11	AO2+	Output current 0(4)...20 mA ≙ 0...motor nom. current, R_L ≤ 700 ohm
12	- - - -	12	AO2-	
X22				
13	- - - -	1	DI1	Stop/Start
14	- - - -	2	DI2	Forward/Reverse [1]
15	- - - -	3	DI3	Not in use
16	- - - -	4	DI4	Acceleration & deceleration select [2]
17	- - - -	5	DI5	Constant speed select [3]
18	- - - -	6	DI6	Constant speed select [3]
20	- - - -	7	+24VD	+24 VDC max. 100 mA
21	- - - -	8	+24VD	
22	- - - -	9	DGND1	Digital ground
23	- - - -	10	DGND2	Digital ground
19	- - - -	11	DIIL	Start interlock (0 = stop) [4]
X23				
24	- - - -	1	+24V	Auxiliary voltage output, non-isolated, 24 VDC 250 mA
25	- - - -	2	GND	
X25				
26	- - - -	1	RO1	Relay output 1: ready
27	- - - -	2	RO1	
28	- - - -	3	RO1	
X26				
29	- - - -	1	RO2	Relay output 2: running
30	- - - -	2	RO2	
31	- - - -	3	RO2	
X27				
32	- - - -	1	RO3	Relay output 3: fault (-1)
33	- - - -	2	RO3	
34	- - - -	3	RO3	

Fault

[1] Only effective if par. 10.03 is set to REQUEST by the user.

[2] 0 = open, 1 = closed

DI4	Ramp times according to
0	parameters 22.02 and 22.03
1	parameters 22.04 and 22.05

[3] See par. group 12 CONSTANT SPEEDS.

DI5	DI6	Operation
0	0	Set speed through AI1
1	0	Constant speed 1
0	1	Constant speed 2
1	1	Constant speed 3

[4] See parameter 21.09 START INTRL FUNC.

External control connections (US)

External control cable connections to the RMIO board for the ACS 800 Standard Application Program (Factory Macro US version) are shown below. For external control connections of other application macros and programs, see the appropriate *Firmware Manual*.

Terminal block size

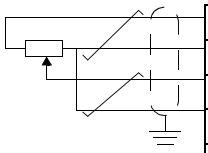
X20 to X27: cables 0.3 to 3.3 mm^2 (22 to 12 AWG)

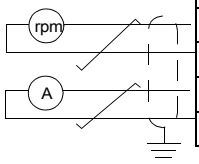
X2: 0.5 to 2.5 mm^2 (22 to 14 AWG)

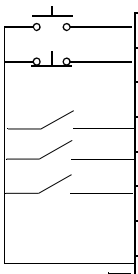
Tightening torque

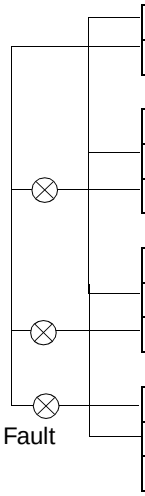
X20 to X27: 0.2 to 0.4 Nm (0.2 to 0.3 lbf ft)

X2: 0.4 to 0.6 Nm (0.3 to 0.4 lbf ft)









2TB		X20		
35	- - - -	1	VREF-	Reference voltage -10 VDC, 1 kohm ≤ R_L ≤ 10 kohm
36	- - - -	2	AGND	
		X21		
1	- - - -	1	VREF+	Reference voltage 10 VDC, 1 kohm ≤ R_L ≤ 10 kohm
2	- - - -	2	AGND	
3	- - - -	3	AI1+	Speed reference 0(2) ... 10 V, R_{in} > 200 kohm
4	- - - -	4	AI1-	
5	- - - -	5	AI2+	By default, not in use. 0(4) ... 20 mA, R_{in} = 100 ohm
6	- - - -	6	AI2-	
7	- - - -	7	AI3+	By default, not in use. 0(4) ... 20 mA, R_{in} = 100 ohm
8	- - - -	8	AI3-	
9	- - - -	9	AO1+	Motor speed 0(4)...20 mA ≙ 0...motor nom. speed, R_L ≤ 700 ohm
10	- - - -	10	AO1-	
11	- - - -	11	AO2+	Output current 0(4)...20 mA ≙ 0...motor nom. current, R_L ≤ 700 ohm
12	- - - -	12	AO2-	
		X22		
13	- - - -	1	DI1	Start (⌐‾)
14	- - - -	2	DI2	Stop (‾⌐)
15	- - - -	3	DI3	Forward/Reverse [1]
16	- - - -	4	DI4	Acceleration & deceleration select [2]
17	- - - -	5	DI5	Constant speed select [3]
18	- - - -	6	DI6	Constant speed select [3]
20	- - - -	7	+24VD	+24 VDC max. 100 mA
21	- - - -	8	+24VD	
22	- - - -	9	DGND1	Digital ground
23	- - - -	10	DGND2	Digital ground
19	- - - -	11	DIIL	Start interlock (0 = stop) [4]
		X23		
24	- - - -	1	+24V	Auxiliary voltage output, non-isolated, 24 VDC 250 mA
25	- - - -	2	GND	
		X25		
26	- - - -	1	RO1	Relay output 1: ready
27	- - - -	2	RO1	
28	- - - -	3	RO1	
		X26		
29	- - - -	1	RO2	Relay output 2: running
30	- - - -	2	RO2	
31	- - - -	3	RO2	
		X27		
32	- - - -	1	RO3	Relay output 3: fault (-1)
33	- - - -	2	RO3	
34	- - - -	3	RO3	

[1] Only effective if par. 10.03 is set to REQUEST by the user.

[2] 0 = open, 1 = closed

DI4	Ramp times according to
0	parameters 22.02 and 22.03
1	parameters 22.04 and 22.05

[3] See par. group 12 CONSTANT SPEEDS.

DI5	DI6	Operation
0	0	Set speed through AI1
1	0	Constant speed 1
0	1	Constant speed 2
1	1	Constant speed 3

[4] See parameter 21.09 START INTRL FUNC.

RMIO board specifications

Analogue inputs

	With Standard Application Program two programmable differential current inputs (0 mA / 4 mA ... 20 mA, R_{in} = 100 ohm) and one programmable differential voltage input (-10 V / 0 V / 2 V ... +10 V, R_{in} > 200 kohm).
	The analogue inputs are galvanically isolated as a group.
Isolation test voltage	500 VAC, 1 min
Max. common mode voltage between the channels	±15 VDC
Common mode rejection ratio	$\geq$ 60 dB at 50 Hz
Resolution	0.025 % (12 bit) for the -10 V ... +10 V input. 0.5 % (11 bit) for the 0 ... +10 V and 0 ... 20 mA inputs.
Inaccuracy	± 0.5 % (Full Scale Range) at 25 °C (77 °F). Temperature coefficient: ± 100 ppm/°C (± 56 ppm/°F), max.

Constant voltage output

Voltage	+10 VDC, 0, -10 VDC ± 0.5 % (Full Scale Range) at 25 °C (77 °F). Temperature coefficient: ± 100 ppm/°C (± 56 ppm/°F) max.
Maximum load	10 mA
Applicable potentiometer	1 kohm to 10 kohm

Auxiliary power output

Voltage	24 VDC ± 10 %, short circuit proof
Maximum current	250 mA (without any optional modules inserted onto slots 1 and 2)

Analogue outputs

	Two programmable current outputs: 0 (4) to 20 mA, $R_L \leq$ 700 ohm
Resolution	0.1 % (10 bit)
Inaccuracy	± 1 % (Full Scale Range) at 25 °C (77 °F). Temperature coefficient: ± 200 ppm/°C (± 111 ppm/°F) max.

Digital inputs

	With Standard Application Program six programmable digital inputs (common ground: 24 VDC, -15 % to +20 %) and a start interlock input. Group isolated, can be divided in two isolated groups (see *Isolation and grounding diagram* below).
	Thermistor input: 5 mA, < 1.5 kohm ⏏ “1” (normal temperature), > 4 kohm ⏏ “0” (high temperature), open circuit ⏏ “0” (high temperature).
	Internal supply for digital inputs (+24 VDC): short circuit proof. An external 24 VDC supply can be used instead of the internal supply.
Isolation test voltage	500 VAC, 1 min
Logical thresholds	< 8 VDC ⏏ “0”, > 12 VDC ⏏ “1”
Input current	DI1 to DI 5: 10 mA, DI6: 5 mA
Filtering time constant	1 ms

Relay outputs

	Three programmable relay outputs
Switching capacity	8 A at 24 VDC or 250 VAC, 0.4 A at 120 VDC
Minimum continuous current	5 mA rms at 24 VDC
Maximum continuous current	2 A rms
Contact material	Silver Cadmium Oxide (AgCdO)
Isolation test voltage	4 kVAC, 1 minute

DDCS fibre optic link

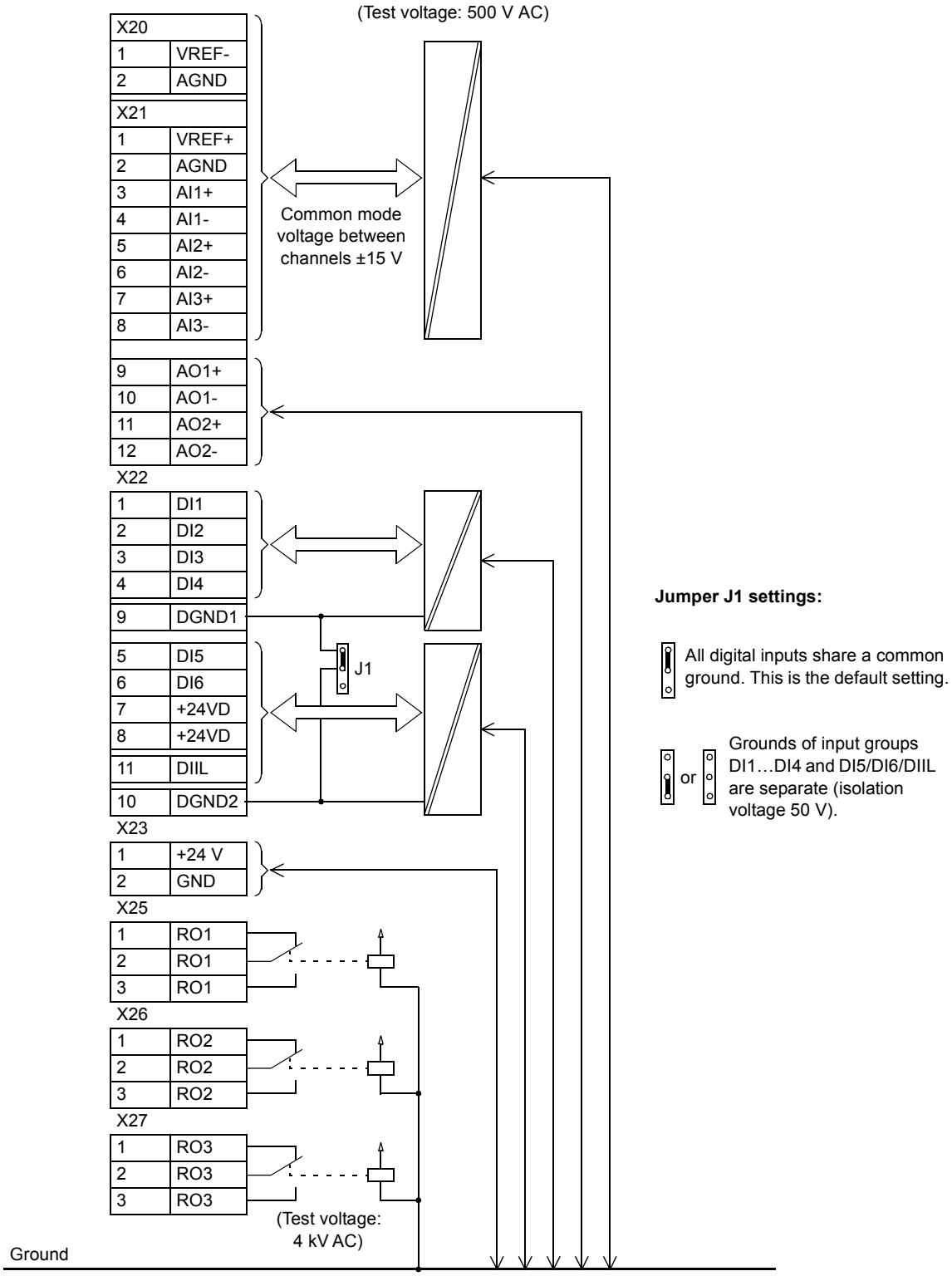
	With optional communication adapter module RDCO. Protocol: DDCS (ABB Distributed Drives Communication System)

24 VDC power input

Voltage	24 VDC ± 10 %
Typical current consumption (without optional modules)	250 mA
Maximum current consumption	1200 mA (with optional modules inserted)

The terminals on the RMIO board as well as on the optional modules attachable to the board fulfil the Protective Extra Low Voltage (PELV) requirements stated in EN 50178 provided that the external circuits connected to the terminals also fulfil the requirements.

Isolation and grounding diagram



Installation checklist

What this chapter contains

This chapter represents the installation checklist.

General

It is advisable to go through the checklist below together with another person. The mechanical and electrical installation must be checked before start-up. Study carefully the *Safety Instructions* on the first pages of this manual before working on the unit.

INSTALLATION CHECKLIST

Check

MECHANICAL INSTALLATION

☐ The ambient operating conditions are allowable. (See chapter *Technical data*.)

☐ The unit is fixed properly. (See chapter *Mechanical installation.*)

☐ The cooling air will flow freely:

- the lifting bars (if used) are removed. (See chapter *Mechanical installation.*)
- the cabinet roof is lifted up (if a double roof). (See chapter *Mechanical installation.*)

☐ The applicability of the motor and the driven equipment. (See *Safety instructions* and chapter *Technical data.*)

ELECTRICAL INSTALLATION (See chapter *Electrical installation.*)

☐ Joining of the shipping splits (if the drive is split):

- The DC busbars and PE busbars are properly connected (See chapter *Mechanical installation.*)
- The control cables are properly connected. (See chapter *Mechanical installation.*)

☐ The converter unit is earthed properly.

☐ The mains voltage matches the frequency converter nominal input voltage.

☐ The setting of the internal 220/115 V transformer corresponds to the supply voltage. The transformer is located in the Auxiliary Control Unit.

☐ The mains (input power) connections at U1, V1 and W1 are OK.

☐ The appropriate mains fuses are installed. (See chapter *Technical data.*)

INSTALLATION CHECKLIST

- ☐ The appropriate DC fuses are installed. (See chapter *Technical data*.)
- ☐ The motor is of correct voltage.
- ☐ The motor star/delta connection at the motor terminal box is correct.
- ☐ Motor cable routing.
- ☐ Check that the toroidal cores are properly installed on the motor cable when a common mode filter is required.
- ☐ The motor connections at U2, V2 and W2 are OK.
- ☐ The unused conductive sleeves at cable entries are tied up with cable ties.
- ☐ There are no power factor compensation capacitors in the motor cable.
- ☐ The control connections inside the frame are OK.
- ☐ If a pulse encoder is used, check the encoder cables and correct direction of rotation [see chapter *Electrical installation* and *Pulse Encoder Interface Module RTAC-0x User's Manual* [3AFE 64486853 (English)]].
- ☐ Thermistor cables. The connections are appropriate for the sensor used in the motor.
- ☐ Prevention of Unexpected Start cables.
- ☐ Emergency stop cables.
- ☐ If other external cables are used, make sure that both ends of the cables are connected and the cables do not cause any damage or danger when power is being switched on.
- ☐ Cleanliness of the cabinet and surroundings, e.g.:
  - there are no tools or other foreign objects inside the cabinet or waste left from installation e.g. cable trimmings
  - there is no garbage under the cabinet (the cooling air fan will draw the garbage inside the cabinet)
  - When there is a cable conduit below the cabinet, cooling air flow from below is prevented by bottom plates around the cable entries. (See chapter *Mechanical installation*.)
- ☐ Mains voltage cannot be applied to the output of the drive (with bypass connection).

Start-up

What this chapter contains

This section describes the hardware commissioning of an ACS800-17 drive section.

General

Perform the drive section commissioning according to this section. For the drive control firmware commissioning, refer to the application program *Firmware Manual*. Perform the supply section commissioning according to the instructions given in the *IGBT Supply Sections User's Manual* [3BFE 64013700 (English)].

WARNING! The work described in this chapter must only be carried out by a qualified electrician. The *Safety Instructions* on the first pages of this manual must be followed. Ignoring the safety instructions can cause injury or death.

WARNING! When the main disconnecting device of the Supply Section is closed (DC busbar is live), **never remove or insert the fuses of a drive section**.

Note: The drive section must only be energised/de-energised by operating the main disconnecting device in the supply section.

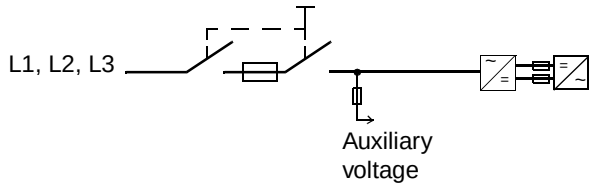
Action	Information
Checks with no voltage connected	
WARNING! Ensure that the disconnector of the supply transformer is locked to open position, i.e. no voltage is, or can be connected to the drive inadvertently. Check also by measuring that no voltage is actually connected. If the motor has a safety switch, make sure that it is open. If the motor has no safety switch, open the circuit Prevention of Unexpected Start (if available).	
☐ Find out the following data for each drive section and note down any differences in the delivery documents: - Motor, pulse encoder and cooling fan rating plate data correspond to the values in the motor list. - Motor temperature measurement method: Pt 100, PTC or other. - Cooling of separately ventilated motors - Ensure that the fan motor always starts prior to the drive. Check the current drawn by the fan, the overcurrent protection setting, and the functioning of the fan start/stop circuit. - Direction of motor rotation - Maximum and minimum speeds, fixed speeds - Speed scaling factor, gear ratio, roll diameter etc. - Acceleration and deceleration times - Inertia compensation - Means of stopping the machinery Can the free rotation of the driven machine be stopped if necessary, e.g. in power cut? Check the mechanical brakes. - Operating modes: stop mode etc.	See the circuit diagrams of the drive system.
☐ Check that the fan motor protection switches (F10.x) and 24 V auxiliary voltage (optional) switch (F13) are on.	See the circuit diagrams delivered with the device.

Action	Information

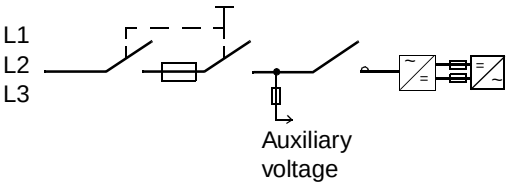
Connecting voltage to the drive

The possible supply disconnecting and switching options are shown below. See the circuit diagrams delivered with the unit for the actual connections (customized configurations).

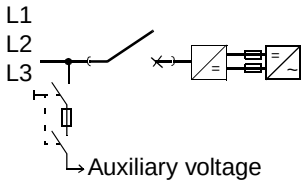
Switch fuse



Switch fuse and contactor



Air circuit breaker



WARNING! When the disconnecting device(s) of the Supply Section are closed, the voltage will also be connected to the Auxiliary Control Unit and to auxiliary circuits - also to the ones wired to drive sections. The DC busbars will become live, as will all the inverters connected to the DC busbars. The DC busbars will be powered to a voltage of 1.35· U_1.

Make sure that it is safe to connect voltage to the Supply Section. Ensure that:

- Nobody is working on the unit or circuits that are wired from outside into the cabinets.
- It is safe to start the motor.
- All cabinet doors are closed.

☐	Disconnect the 230 VAC cables that lead from the terminal blocks to the outside of the equipment and have not yet been checked, and the connections which may not yet have been completed.	
☐	Disconnect the communication link to the overriding system by removing the fibre optic cables.	See the circuit diagrams delivered with the device.
☐	Be ready to trip the main breaker of the supply transformer in case something abnormal occurs.	
☐	Ensure that all cabinet doors are closed.	
☐	Close the main breaker of the supply transformer.	
☐	Close the main disconnecting device of the Supply Section.	
☐	Close the main disconnecting switch of the auxiliary circuit (if present).	
☐	Close the main contactor/breaker of the Supply Unit.	

	Action	Information
Checks with voltage connected to the drive section		
☐	Set the drive parameters according to the application *Firmware Manual*.	
☐	Check that the Prevention of Unexpected Start (if available) is working: - Stop the drive by a Stop command and wait until the drive has stopped. - Open the Prevention of Unexpected Start switch by opening the switch on the control desk: the circuit will open. The lamp (if fitted) on the desk should be lit. - Give a Start command. The drive should not start. - Reset the drive.	See the circuit diagrams delivered with the device.
On-load checks		
☐	Check that the cooling air fans rotate freely in the right direction, and the air flows upwards.	A paper sheet set on the lower gratings stays. The fan runs noiselessly.
☐	Check the rotation direction of the motor.	
☐	Check the pulse encoder functioning (if present)	See *Pulse Encoder Interface Module RTAC-0x User's Manual* [3AFE 64486853 (English)].
☐	Check the emergency stop function of the system from each operating place.	
Checks of the overriding control link (if in use)		
☐	Disconnect all voltages: open the main contactor/breaker (if present), open the main disconnecting device.	
☐	Connect the communication link to the overriding system by connecting the fibre optic cables.	See the circuit diagrams delivered with the device.
☐	Power the unit up.	
☐	Check - the start/stop functions - speed/torque references - alarm/fault words - function in case of a communication break - updating interval of the drive software - other items essential to the application	

Preventive maintenance

What this chapter contains

This chapter represents how to maintain the drive in operational condition.

General

WARNING! The *Safety Instructions* on the first pages of this manual must be followed. Negligence of these instructions can cause injury or death.

If installed in an appropriate environment, the drive requires very little maintenance. An annual check-up for dust and corrosion accumulation on the surfaces inside the cabinet is recommended.

Air filters

When having filtering for cooling air, check and clean or replace filter mats if dirty. Wash dirty filter mats with water (60 °C) and detergent.

Heatsink

The drive can run into overtemperature faults if the heatsink is not clean. In normal environment, the heatsink should be checked and cleaned annually.

Use compressed air to remove dust from the heatsink. (The airflow direction must be from bottom to top.) Also, use a vacuum cleaner at the air outlet to trap the dust. Fan rotation must be prevented in order to prevent bearing damage.

Relays

Relays should be checked for function and all connections should be inspected and checked for tightness. Any signs of corrosion, especially in ground components, shall be cleaned off.

Fan

The cooling fan lifespan is approximately 40 000 hours. The actual lifespan depends on the drive usage and ambient temperature.

Fan failure can be predicted by increasing noise from fan bearings and gradual rise in the heatsink temperature in spite of heatsink cleaning. If the drive is used in a critical part of a process, fan replacement is recommended once these symptoms appear.

Spare modules

It is recommended to reform the capacitors of the spare modules once a year by e.g. replacing the cabinet modules with their spare modules. This also equalizes wear on the modules. See section *Capacitors* below.

Capacitors

The drive intermediate circuit employs several electrolytic capacitors. The lifespan of the capacitors is approximately 100 000 hours, depending on the drive loading and the ambient temperature.

Capacitor life can be prolonged by lowering the ambient temperature. It is not possible to predict a capacitor failure.

Capacitor failure is usually followed by a mains fuse failure or a fault trip. Contact ABB if capacitor failure is suspected. Replacements are available from ABB. Do not attempt operation with other than ABB specified spare parts.

Reforming

Converter DC link capacitors need to be reformed (re-aged) if the converter has been non-operational for more than one year. Without reforming capacitors may be damaged when the converter starts to operate. The reforming methods introduced here require that the converter has been stocked clean and dry. It is recommended to reform the capacitors once a year.

How to check the converter age

Converter serial number defines the week, when the converter has been built:

- 8 digit: e.g. 18250125, 1 denotes manufacturing country (1 = Finland), 8 manufacturing year (1998), 25 manufacturing week and 0125 running manufacturing number.
- 10 digit: e.g. 1983200725, 1 denotes manufacturing country, 98 manufacturing year, 32 manufacturing week and 00725 running manufacturing number.

Reforming time

The intermediate circuit of the converter is kept at its nominal voltage for the reforming time to “wake up” the capacitors. The reforming time required depends on how long the converter has been stocked (non-operational).

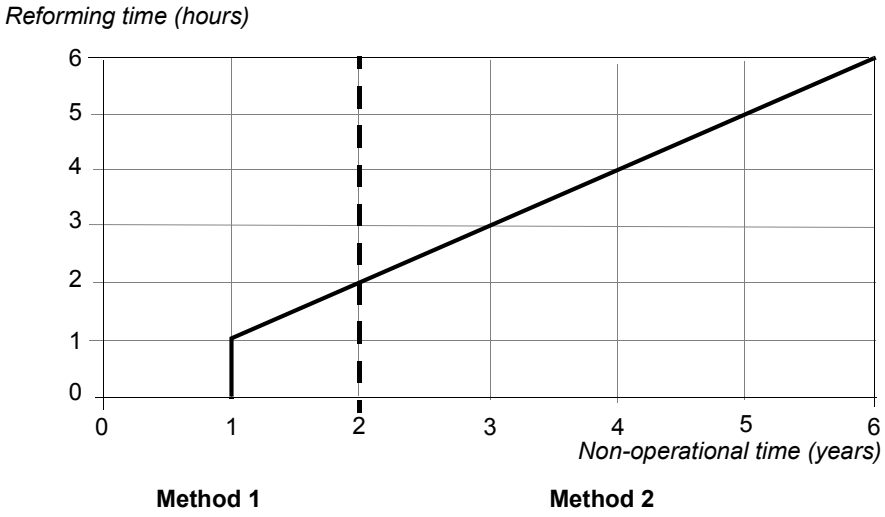


Figure 1. Capacitor reforming time for Method 1 and Method 2.

Converters stocked (non-operational) for less than 2 years

Switch the power on to the converter for a time given in *Figure 1* (Method 1). The converter “wakes up” its capacitors by itself. Power the converters up once a year to keep the capacitors in operational condition.

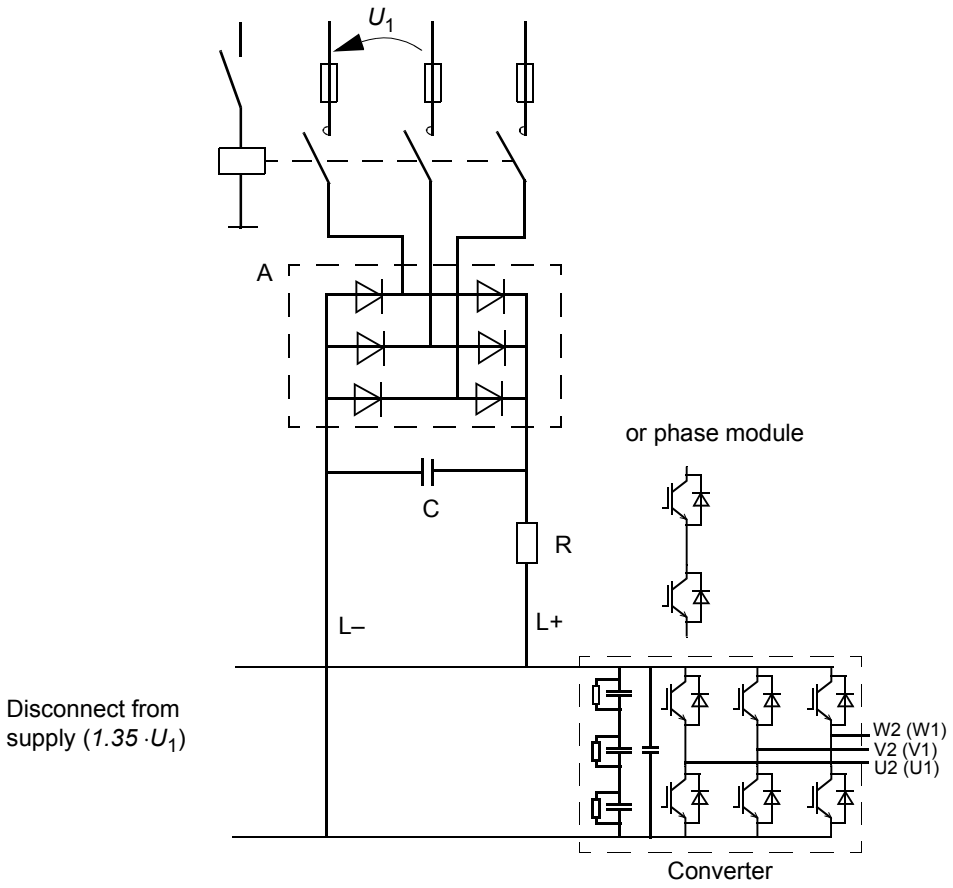
Converters stocked (non-operational) for 2 years and over

Use Method 2 A or Method 2 B (both explained below) for capacitor reforming if the converter has been stocked or non-operational for two or more years.

Method 2 A

Capacitor reforming is realised by connecting a rectifier and a resistor circuit to the converter DC link. The reforming circuit and component values for different voltages are given below. See *Figure 1* for reforming time.

WARNING! The converter supply must be disconnected while the reforming circuit is connected.



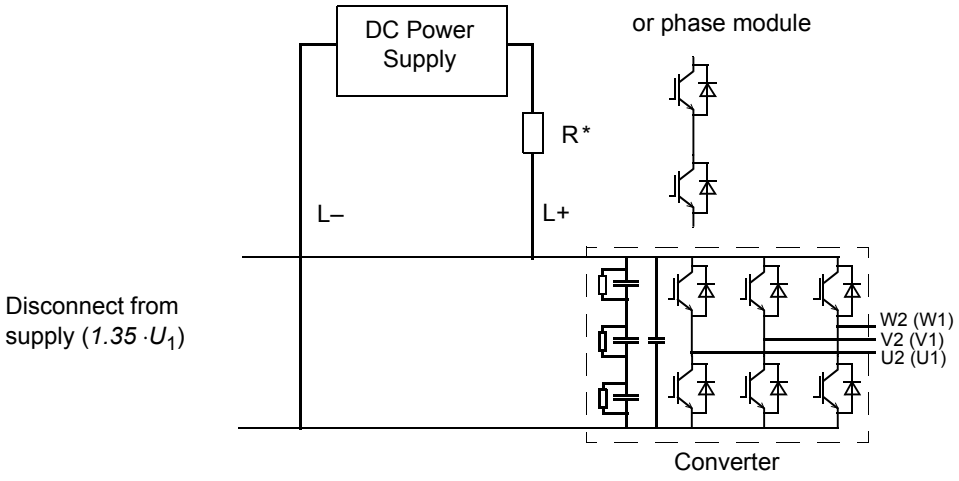
Supply Voltage	Recommended Components		
	A*	**R**	**C**
380 V < U_1 < 415 V	SKD 82/16	220 Ohm / 700 W	22 nF / 2000 V
380 V < U_1 < 500 V	SKD 82/16	470 Ohm / 1200 W	22 nF / 2000 V
525 V < U_1 < 690 V	SKD 82/16	680 Ohm / 1700 W	22 nF / 2000 V

* rectifier bridge by Semikron (82 A, 1600 V) or equivalent

Method 2 B

Capacitor reforming is based on a DC power supply connected to the converter DC link. Power supply current charges the converter capacitors. If power supply cannot limit the current, voltage is increased gradually (with e.g. 100 V steps). Maximum recommended reforming current is 500 mA. An appropriate reforming voltage is (1.35 ... √2) · U_1. The reforming circuit is shown below. See *Figure 1* for reforming time.

WARNING! The converter supply must be disconnected while the reforming circuit is connected.



* R = 100 Ohm / 500 W

Technical data

What this chapter contains

This chapter describes the technical data concerning the ACS800-17.

Ratings

The ratings for the ACS800-17 with 50 Hz and 60 Hz supplies are given below.

Drive type	Drive frame size	Normal use			Duty cycle 1/5min		Duty cycle 10/60s	
		I_{2N}	S_N	P_N	I_{2hd} 4/5min	I_{2hd} 1/5min	I_{2hd} 50/60s	I_{2hd} 10/60s
		[A]	[kVA]	[kW]	[A]	[A]	[A]	[A]
Supply voltage range 380, 400 or 415 V								
ACS800-17-0120-3	R7i	178	120	90	147	221	147	294
ACS800-17-0185-3	R8i	259	185	132	194	291	178	356
ACS800-17-0225-3	R8i	312	225	160	234	351	216	432
ACS800-17-0265-3	R8i	379	265	200	284	426	260	520
ACS800-17-0335-3	R9i	474	335	250	356	533	316	632
ACS800-17-0405-3	R9i	576	405	315	432	648	395	790
ACS800-17-0630-3	R11i	907	630	500	680	1020	600	1200
ACS800-17-0765-3	R11i	1094	765	630	821	1231	751	1502
ACS800-17-0935-3	R12i	1336	935	710	1002	1503	901	1802
ACS800-17-1125-3	R12i	1624	1125	900	1218	1827	1126	2252
Supply voltage range 380, 400, 415, 440, 460, 480 or 500 V								
ACS800-17-0100-5	R6i	112	100	75	84	126	84	168
ACS800-17-0140-5	R7i	164	140	110	135	203	135	270
ACS800-17-0215-5	R8i	246	215	160	185	277	164	328
ACS800-17-0255-5	R8i	295	255	200	221	332	200	400
ACS800-17-0325-5	R8i	368	325	250	276	414	240	480
ACS800-17-0395-5	R9i	448	395	315	336	504	300	600
ACS800-17-0495-5	R9i	565	495	400	424	636	365	730
ACS800-17-0770-5	R11i	887	770	630	665	998	570	1140
ACS800-17-0935-5	R11i	1073	935	710	805	1208	694	1388
ACS800-17-1095-5	R12i	1263	1095	900	947	1421	855	1710
ACS800-17-1385-5	R12i	1593	1385	1120	1195	1793	1040	2080
Supply voltage range 525, 550, 575, 600, 660 or 690 V								
ACS800-17-0120-6	R7i	105	120	90	88	132	88	176
ACS800-17-0205-6	R8i	176	205	160	132	198	127	254
ACS800-17-0255-6	R8i	210	255	200	158	236	150	300
ACS800-17-0315-6	R8i	264	315	250	198	297	179	358
ACS800-17-0375-6	R9i	310	375	315	233	349	225	450
ACS800-17-0485-6	R9i	410	485	400	308	461	265	530
ACS800-17-0750-6	R11i	630	750	630	473	709	428	856
ACS800-17-0900-6	R11i	755	900	710	566	849	504	1008
ACS800-17-1045-6	R12i	874	1045	800	656	983	641	1282
ACS800-17-1385-6	R12i	1156	1385	1120	867	1301	755	1510

Normal Use

I_{2N} Rated rms output current (= maximum continuous output current)

S_N Rated apparent output power

P_N Typical motor power. The power ratings in kW apply to most IEC 34 motors.

Duty Cycle

I_{2hd} Rated rms output current

The current ratings are the same regardless of the supply voltage within one voltage range. The rated current of the drive must be higher than or equal to the rated motor current to achieve the rated motor power given in the table.

***Note 1:** The load capacity (current and power) decreases if the installation site altitude exceeds 1000 metres, or if the ambient temperature exceeds 40 °C (units with degree of protection IP 21/22/42/54).*

***Note 2:** Usually du/dt filters are needed at the output of 525 V to 690 V units with random wound motors. No du/dt filters are usually required with form wound motors.*

Output current temperature derating

The output current is calculated by multiplying the current given in the rating table by the derating factor.

Temperature derating factor for degree of protection IP 21/22/42/54:

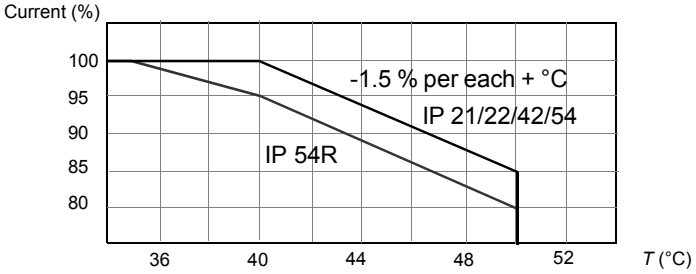
- *General rule:* Above +40 °C, the rated output current is decreased 1.5 % for every additional 1 °C (up to +50 °C).
- *Example 1:* If the ambient temperature is 50 °C the derating factor is

  100 % - 1.5 $\frac{\%}{°C}$ · 10 °C = 85 % or 0.85. The output current is then

  0.85 · I_{2N} or I_{2hd}.

Derating diagram

The effect of ambient temperature on the continuous load capacity of the AC800-17 is shown below.



Input power connection

Voltage (U_1):
380/400/415 VAC 3-phase ± 10 % for 400 VAC units
380/400/415/440/460/480/500 VAC 3-phase ± 10 % for 500 VAC units
525/550/575/600/660/690 VAC 3-phase ± 10 % for 690 VAC units

Short circuit capability IEC 439-1**:** The rated short time withstand current is given below

Frame size	$I_{cw\,/\,1\,s}$ **kA**	I_{pk} **kA**
ACS800-17: R8i, R9i	38	78
ACS800-17: R11i, R12i	50	105

Frequency: 48 to 63 Hz, maximum rate of change 17 %/s

Input voltage unbalance: ± 3 % (EN 60204-1)

Power factor:

$\cos \varphi_1 = 1.00$ (fundamental at nominal load)

$\lambda = I_1/I_{rms} \cdot \cos \varphi_1 > 0.98$ (total), where

λ is power factor,

I_1 is fundamental input current rms value,

I_{rms} is total input current rms value.

Motor connection

Voltage (U_2): 0 to U_1, 3-phase symmetrical

Frequency: DTC mode: 0 to 3.2 · f_{FWP}. Maximum frequency 300 Hz.

$$f_{FWP} = \frac{U_{Nmains}}{U_{Nmotor}} \cdot f_{Nmotor}$$

f_{FWP}: Frequency at field weakening point; U_{Nmains}: Mains (input power) voltage; U_{Nmotor}: Rated motor voltage; f_{Nmotor}: Rated motor frequency

Scalar control mode: 0 to 300 Hz

With du/dt filter (DTC and Scalar Control modes): 0 to 120 Hz

Frequency resolution: 0.01 Hz

Continuous current: 1.0 · I_{2N} (normal use)

Short term overload capacity: According to rating tables on page *97*.

Field weakening point: 8 to 300 Hz

Switching frequency: 3 kHz

Maximum recommended motor cable length: For cables longer than 500 metres / 1640 ft (cumulative length in case of parallel connected motors), an ABB representative must be consulted. With pulse encoder speed measurement, the maximum cable length is 300 m. With du/dt filters, refer to *du/dt Filters Installation Guide* [3AFE 58933368 (English)]. For additional EMC requirements on cable length, refer to section *CE marking* below.

Motor bearings: Insulated bearing at the non-driven end is recommended.

Cable types: The tables below give the copper and aluminium cable types for different load currents (I_{Lmax}). A correction factor of K = 0.70 has been used (max. 9 cables laid on a cable ladder side by side, three ladders on top of each other, ambient temperature 30 °C (86 °F), EN 60204-1 and IEC 364-5-523)

COPPER CABLES WITH A CONCENTRIC COPPER SCREEN		
I_{Lmax} [A]	Cable type	Diameter [mm]
255	3×185 + 95	50
274	2 × (3×70 + 35)	2 × 32
301	3×240 + 120	55
334	2 × (3×95 + 50)	2 × 38
386	2 × (3×120 + 70)	2 × 41
446	2 × (3×150 + 70)	2 × 44
510	2 × (3×185 + 95)	2 × 50
579	3 × (3×120 + 70)	3 × 41
602	2 × (3×240 + 120)	2 × 55
669	3 × (3×150 + 70)	3 × 44
765	3 × (3×185 + 95)	3 × 50
772	4 × (3×120 + 70)	4 × 41
892	4 × (3×150 + 70)	4 × 44
903	3 × (3×240 + 120)	3 × 55
1020	4 × (3×185+ 95)	4 × 50

ALUMINIUM CABLES WITH A CONCENTRIC COPPER SCREEN		
I_{Lmax} [A]	Cable type	Diameter [mm]
260	2 × (3×95Al + 29Cu)	2 × 38
302	2 × (3×120Al + 41Cu)	2 × 41
348	2 × (3×150Al + 41Cu)	2 × 44
398	2 × (3×185Al + 57Cu)	2 × 49
470	2 × (3×240Al + 72Cu)	2 × 54
522	3 × (3×150Al + 41Cu)	3 × 44
597	3 × (3×185Al + 57Cu)	3 × 49
696	4 × (3×150Al + 41Cu)	4 × 44
705	3 × (3×240Al + 72Cu)	3 × 54
796	4 × (3×185Al + 57Cu)	4 × 49
940	4 × (3×240Al + 72Cu)	4 × 54
995	5 × (3×185Al + 57Cu)	5 × 49
1175	5 × (3×240Al + 72Cu)	5 × 54

Efficiency and cooling method

Efficiency: Approximately 96 %.

Cooling method: Internal fan, flow direction from the bottom to the top

Ambient conditions

Environmental limits of the drives are given below. The drives are to be used in a heated, indoor, controlled environment.

	Operation installed for stationary use	**Storage** in the protective package	**Transportation** in the protective package
Installation site altitude	Nominal output power at 0 to 1000 m (3300 ft) above sea level [1)]	-	-
Air temperature	0 to +40 °C (32 to 104 °F) [2)] (IP 21/22/42/54) 0 to +35 °C (32 to 95 °F) [2)] (IP 54R)	-40 to +70 °C (-40 to +158 °F)	-40 to +70 °C (-40 to +158 °F)
Relative humidity	5 to 95%	Max. 95%	Max. 95%
	No condensation allowed. Maximum allowed relative humidity is 60% in the presence of corrosive gases.		
Contamination levels (IEC 721-3-3)	No conductive dust allowed.		
	Boards without coating: Chemical gases: Class 3C1 Solid particles: Class 3S2 **Boards with coating:** Chemical gases: Class 3C2 Solid particles: Class 3S2	**Boards without coating:** Chemical gases: Class 1C2 Solid particles: Class 1S3 **Boards with coating:** Chemical gases: Class 1C2 Solid particles: Class 1S3	**Boards without coating:** Chemical gases: Class 2C2 Solid particles: Class 2S2 **Boards with coating:** Chemical gases: Class 2C2 Solid particles: Class 2S2
Atmospheric pressure	70 to 106 kPa 0.7 to 1.05 atmospheres	70 to 106 kPa 0.7 to 1.05 atmospheres	60 to 106 kPa 0.6 to 1.05 atmospheres
Vibration (IEC 68-2-6)	Max. 0.3 mm (0.01 in.) (2 to 9 Hz), max. 1 m/s^2 (3.3 ft./s^2) (9 to 200 Hz) sinusoidal	Max. 1.5 mm (0.06 in.) (2 to 9 Hz), max. 5 m/s^2 (16.4 ft./s^2) (9 to 200 Hz) sinusoidal	Max. 3.5 mm (0.14 in.) (2 to 9 Hz), max. 15 m/s^2 (49 ft./s^2) (9 to 200 Hz) sinusoidal
Shock (IEC 68-2-29)	Not allowed	Max. 100 m/s^2 (330 ft./s^2), 11 ms	Max. 100 m/s^2 (330 ft./s^2), 11 ms
Free fall	Not allowed	250 mm (10 in.) for weight under 100 kg (220 lbs.) 100 mm (4 in.) for weight over 100 kg (220 lbs.)	250 mm (10 in.) for weight under 100 kg (220 lbs.) 100 mm (4 in.) for weight over 100 kg (220 lbs.)

[1)] At sites over 1000 m (3300 ft.) above sea level, the maximum output current is derated as follows. If the installation site is higher than 2000 m (6600 ft.) above sea level, please contact your local ABB distributor or office for further information.

$I_{max} = I_{N40C} \cdot (100\ \% - 1\ \% \cdot (h - 1000\ m)/(100\ m) + 1.5\ \% \cdot (40\ °C - T_{amb}))$

where

h altitude above sea level

I_{N40C} drive nominal current at 40 °C

T_{amb} maximum ambient temperature.

Note: $I_{max} < I_{N40C}$ and $T_{amb} < 40$ °C. At 2000...4000 m optional “varistors” are needed.

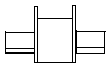
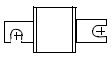
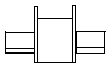
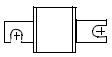
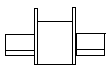
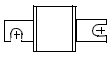
[2)] See section *Output current temperature derating*.

Fuses

Only ultra rapid fuses guarantee proper protection for the rectifier semiconductors.

AC fuses

The a.c. fuses (Bussmann) used in the ACS800-17 supply sections are listed below.

Frequency converter type	Frame size	Supply section type	Fuse					
			U_N V	I_N A	Pre-arching integral A^2s	Type		Size
Supply voltage 400V IGBT supply								
ACS800-17-0120-3	R7i	-	690	350	10000	170M3818	DIN 43620	DIN1*
ACS800-17-0185-3	R8i	-	660	630	31000	170M6810		DIN3
ACS800-17-0225-3	R8i	-	660	630	31000	170M6810		DIN3
ACS800-17-0265-3	R8i	-	660	630	31000	170M6810		DIN3
ACS800-17-0335-3	R9i	-	660	1000	140000	170M6814		DIN3
ACS800-17-0405-3	R9i	-	660	1000	140000	170M6814		DIN3
ACS800-17-0630-3	R11i	ACA 635-0765-3	690	700	60500	170M5874	DIN 43653	2
ACS800-17-0765-3	R11i	ACA 635-0765-3	690	700	60500	170M5874		2
ACS800-17-0935-3	R12i	ACA 635-1125-3	690	900	125000	170M5876		2
ACS800-17-1125-3	R12i	ACA 635-1125-3	690	900	125000	170M5876		2
Supply voltage 500V IGBT supply								
ACS800-17-0100-5	R6i	-	660	200	2200	170M3815	DIN 43620	DIN1*
ACS800-17-0140-5	R7i	-	690	350	10000	170M3818		DIN1*
ACS800-17-0215-5	R8i	-	660	630	31000	170M6810		DIN1*
ACS800-17-0255-5	R8i	-	660	630	31000	170M6810		DIN1*
ACS800-17-0325-5	R8i	-	660	630	31000	170M6810		DIN1*
ACS800-17-0395-5	R9i	-	660	1000	140000	170M6814		DIN3
ACS800-17-0495-5	R9i	-	660	1000	140000	170M6814		DIN3
ACS800-17-0770-5	R11i	ACA 635-0935-5	690	700	60500	170M5874	DIN 43653	2
ACS800-17-0935-5	R11i	ACA 635-0935-5	690	700	60500	170M5874		2
ACS800-17-1095-5	R12i	ACA 635-1385-5	690	900	125000	170M5876		2
ACS800-17-1385-5	R12i	ACA 635-1385-5	690	900	125000	170M5876		2
Supply voltage 690V IGBT supply								
ACS800-17-0120-6	R7i	-	660	200	2200	170M3815	DIN 43620	DIN1
ACS800-17-0205-6	R8i	-	1250	400	19500	170M6303		3SHT
ACS800-17-0255-6	R8i	-	1250	400	19500	170M6303		3SHT
ACS800-17-0315-6	R8i	-	1250	400	19500	170M6303		3SHT
ACS800-17-0375-6	R9i	-	1250	630	83500	170M6205		3SHT
ACS800-17-0485-6	R9i	-	1250	630	83500	170M6205		3SHT
ACS800-17-0750-6	R11i	ACA 635-0900-6	690	900	125000	170M5876	DIN 43653	2
ACS800-17-0900-6	R11i	ACA 635-0900-6	690	900	125000	170M5876		2
ACS800-17-1095-6	R12i	ACA 635-1385-6	690	700	60500	170M5874		2
ACS800-17-1385-6	R12i	ACA 635-1385-6	690	700	60500	170M5874		2

PDM code 00145936-G

IGBT supply unit DC fuses

The d.c. fuses (Bussmann) used in the IGBT supply units are listed below.

IGBT Supply Section Frame Type	U_N [V]	Size	I_N [A]	Type	IGBT Supply Section Frame Type	U_N [V]	Size	I_N [A]	Type
415 V and 500 V Range					690 V Range				
R11i R12i	660V	3	1000	170M6814	R11i R12i	1250V	3SHT	630	170M6205

PDM code 00145936-G

Cable entries

Tightening torque

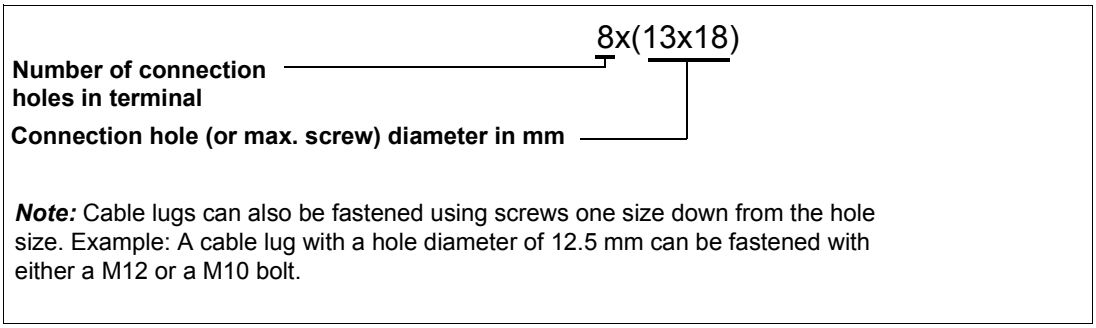
The tightening torques for screw connections, applicable to zinc and chrome platings and screw strength class 8.8 are listed below.

Screw	Torque (Nm) *	
	Soft aluminium	Alloyed aluminium and copper
M5	3.5	3.5
M6	6	9
M8	17	20
M10	35	40
M12	55	70
M16	130	180

* valid also for greased screws

Marking

Cable connections are marked in the following tables as explained below. The terminals accept cable lugs according to DIN 46234 for copper cables and DIN 46329 for aluminium cables.



Note: Cable lugs can also be fastened using screws one size down from the hole size. Example: A cable lug with a hole diameter of 12.5 mm can be fastened with either a M12 or a M10 bolt.

Connection holes

The connection holes for mains and motor cable lugs are given below.

Drive type	Frame size	Supply section type	Holes for cable lugs per phase 1)	Number of cable entries at bottom (diameter 60 mm) mains/motor	Bottom plate opening dimensions (mm)	Number of cable entries at top (diameter 60 mm)
Supply voltage 400V IGBT supply						
ACS800-17-0120-3	R7i	-	*	3	75x239	3
ACS800-17-0185-3	R8i	-	4x(13x18)	6	75x239	6
ACS800-17-0225-3	R8i	-	4x(13x18)	6	75x239	6
ACS800-17-0265-3	R8i	-	4x(13x18)	6	75x239	6
ACS800-17-0335-3	R9i	-	4x(13x18)	6	75x239	6
ACS800-17-0405-3	R9i	-	4x(13x18)	6	75x239	6
ACS800-17-0630-3	R11i	ACA 635-0765-3	6x(13x18)	6/9	270x911	6
ACS800-17-0765-3	R11i	ACA 635-0765-3	6x(13x18)	6/9	270x911	6
ACS800-17-0935-3	R12i	ACA 635-1125-3	8x(13x18)	12	195x501	12
ACS800-17-1125-3	R12i	ACA 635-1125-3	8x(13x18)	12	195x501	12
Supply voltage 500V IGBT supply						
ACS800-17-0100-5	R6i	-	*	3	75x239	3
ACS800-17-0140-5	R7i	-	*	3	75x239	3
ACS800-17-0215-5	R8i	-	4x(13x18)	6	75x239	6
ACS800-17-0255-5	R8i	-	4x(13x18)	6	75x239	6
ACS800-17-0325-5	R8i	-	4x(13x18)	6	75x239	6
ACS800-17-0395-5	R9i	-	4x(13x18)	6	75x239	6
ACS800-17-0495-5	R9i	-	4x(13x18)	6	75x239	6
ACS800-17-0770-5	R11i	ACA 635-0935-5	6x(13x18)	6/9	270x911	6
ACS800-17-0935-5	R11i	ACA 635-0935-5	6x(13x18)	6/9	270x911	6
ACS800-17-1095-5	R12i	ACA 635-1385-5	8x(13x18)	6/12	270x911	6
ACS800-17-1385-5	R12i	ACA 635-1385-5	8x(13x18)	6/12	270x911	6
Supply voltage 690V IGBT supply						
ACS800-17-0120-6	R7i	-	*	3	75x239	3
ACS800-17-0205-6	R8i	-	4x(13x18)	6	75x239	6
ACS800-17-0255-6	R8i	-	4x(13x18)	6	75x239	6
ACS800-17-0315-6	R8i	-	4x(13x18)	6	75x239	6
ACS800-17-0375-6	R9i	-	4x(13x18)	6	75x239	6
ACS800-17-0485-6	R9i	-	4x(13x18)	6	75x239	6
ACS800-17-0750-6	R11i	ACA 635-0900-6	6x(13x18)	6/9	270x911	6
ACS800-17-0900-6	R11i	ACA 635-0900-6	6x(13x18)	6/9	270x911	6
ACS800-17-1095-6	R12i	ACA 635-1385-6	8x(13x18)	12	195x501	12
ACS800-17-1385-6	R12i	ACA 635-1385-6	8x(13x18)	12	195x501	12

* Isolated stud terminals for the motor cable:

- maximum number of cable connections per phase: 1
- cable cross section: 25...120 mm^2 (3...250 MCM)
- tightening torque: 30 Nm (265 lbf.in.).

Mains cable terminal: M10 bolt.

1) The number of holes when common output cubicle is used for top exit is as follows:

Frame size	Number of holes per phase
R11i, R12i	8

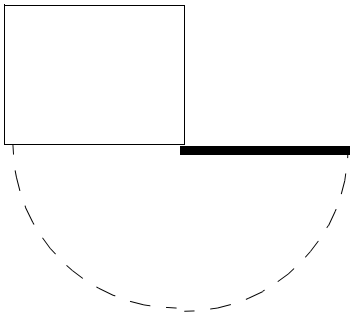
Cabinet

Below are the cabinets, degrees of protection and free space requirements.

Degree of Protection	Space above mm	Space below mm	Space on left/right mm	Space in front/back mm
IP 21, IP 22, IP 42, IP 54, IP 54 R [1]	500	0	0	200/100 [2]

[1] IP 21 = standard, R = air outlet duct

[2] 200 between cabinets when installed back to back



Door opening

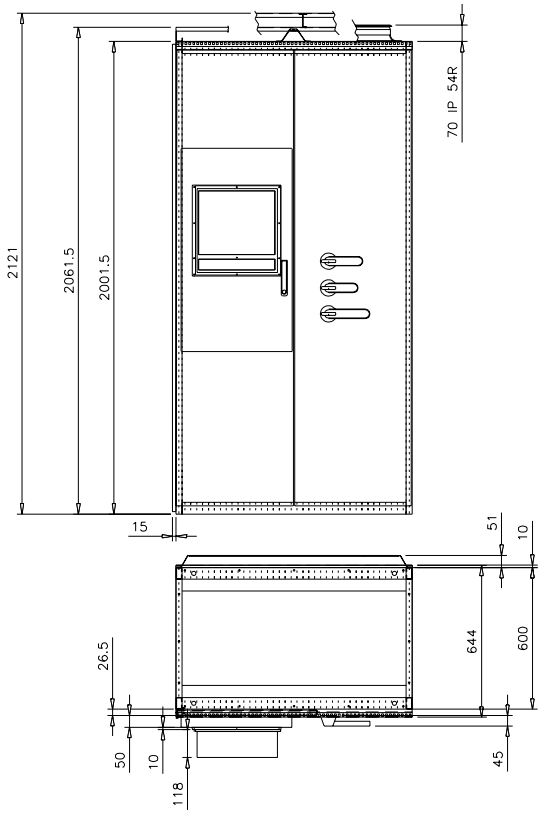
Cooling air, dimensions

This table gives the depth of the cabinet. The height of the switch fuse handle is 45 mm from the cabinet door.

Depth	mm
Depth of the frame	600
Depth of the roof	644
Depth including the door, the frame and the back plate	637
Depth including the door, the frame, the back plate and the flash barrier	678
Added depth including air circuit breaker spacer frame and door frame (measured from door)	60
Added depth of air circuit breaker spacer frame, door frame and transparent cover (measured from door)	178
Added depth of switch fuse (measured from door)	45

This table gives the height of the cabinet.

Height	mm
Height of the cabinet with a double lifted roof	2121
Height of the ACS800-17 cabinet (IP 21)	2062
Height of the IP 54R cabinet	2072



Air flow requirements

Below are cooling air flow requirements, heat losses, dimensions and weights of ACS800-17.

Drive type	IGBT supply			Drive section		Air flow [m^3/h]	Heat loss [kW]	Width [1] [mm]	Weight [kg]
	Frame size	Section type	Module type	Frame size	Module type				
Supply voltage 400V IGBT supply									
ACS800-17-0120-3	R7i	-	ACN634-0120-3	R7i	ACN634-0120-3	1920	4.1	730	305
ACS800-17-0185-3	R8i	-	ACN634-0265-3	R8i	ACN634-0185-3	3650	6.0	1200	625
ACS800-17-0225-3	R8i	-	ACN634-0265-3	R8i	ACN634-0225-3	3650	7.3	1200	625
ACS800-17-0265-3	R8i	-	ACN634-0265-3	R8i	ACN634-0265-3	3650	8.9	1200	625
ACS800-17-0335-3	R9i	-	ACN634-0405-3	R9i	ACN634-0335-3	3650	11.2	1200	655
ACS800-17-0405-3	R9i	-	ACN634-0405-3	R9i	ACN634-0405-3	3650	13.9	1200	655
ACS800-17-0630-3	R11i	ACA 635-0765-3	ACN634-0755-3	R11i	ACN634-0635-3	7280	22.0	3600	1490
ACS800-17-0765-3	R11i	ACA 635-0755-3	ACN634-0755-3	R11i	ACN634-0755-3	7280	27.2	3600	1490
ACS800-17-0935-3	R12i	ACA 635-1125-3	ACN634-1125-3	R12i	ACN634-0935-3	10330	31.7	4600	2530
ACS800-17-1125-3	R12i	ACA 635-1125-3	ACN634-1125-3	R12i	ACN634-1125-3	10330	39.3	4600	2530
Supply voltage 500V IGBT supply									
ACS800-17-0100-5	R6i	-	ACN 634-0140-5	R6i	ACN634-0100-5	1920	3.4	730	305
ACS800-17-0140-5	R7i	-	ACN 634-0140-5	R7i	ACN634-0140-5	1920	4.9	730	305
ACS800-17-0215-5	R8i	-	ACN 634-0325-5	R8i	ACN634-0215-5	3650	7.2	1200	625
ACS800-17-0255-5	R8i	-	ACN 634-0325-5	R8i	ACN634-0255-5	3650	8.8	1200	625
ACS800-17-0325-5	R8i	-	ACN 634-0325-5	R8i	ACN634-0325-5	3650	11.1	1200	625
ACS800-17-0395-5	R9i	-	ACN 634-0495-5	R9i	ACN634-0395-5	3650	13.7	1200	655
ACS800-17-0495-5	R9i	-	ACN 634-0495-5	R9i	ACN634-0495-5	3650	17.4	1200	655
ACS800-17-0770-5	R11i	ACA 635-0935-5	ACN 634-0925-5	R11i	ACN634-0775-5	7280	27.3	3600	1490
ACS800-17-0935-5	R11i	ACA 635-0935-5	ACN 634-0925-5	R11i	ACN634-0925-5	7280	31.7	3600	1490
ACS800-17-1090-5	R12i	ACA 635-1385-5	ACN 634-1385-5	R12i	ACN634-1095-5	10330	38.9	4600	2530
ACS800-17-1385-5	R12i	ACA 635-1385-5	ACN 634-1385-5	R12i	ACN634-1385-5	10330	48.7	4600	2530
Supply voltage 690V IGBTsupply									
ACS800-17-0120-6	R7i	-	ACN 634-0120-6	R7i	ACN634-0120-6	1920	4.1	730	305
ACS800-17-0205-6	R8i	-	ACN 634-0315-6	R8i	ACN634-0205-6	3650	7.2	1200	625
ACS800-17-0255-6	R8i	-	ACN 634-0315-6	R8i	ACN634-0255-6	3650	8.8	1200	625
ACS800-17-0315-6	R8i	-	ACN 634-0315-6	R8i	ACN634-0315-6	3650	10.9	1200	625
ACS800-17-0375-6	R9i	-	ACN 634-0485-6	R9i	ACN634-0375-6	3650	13.4	1200	655
ACS800-17-0485-6	R9i	-	ACN 634-0485-6	R9i	ACN634-0485-6	3650	17.2	1200	655
ACS800-17-0750-6	R11i	ACA 635-0900-6	ACN 634-0905-6	R11i	ACN634-0755-6	7280	27.0	3600	1730
ACS800-17-0900-6	R11i	ACA 635-0900-6	ACN 634-0905-6	R11i	ACN634-0905-6	7280	31.3	3600	1730
ACS800-17-1045-6	R12i	ACA 635-1385-6	ACN 634-1385-6	R12i	ACN634-1045-6	10330	38.1	4600	2530
ACS800-17-1385-6	R12i	ACA 635-1385-6	ACN 634-1385-6	R12i	ACN634-1385-6	10330	48.7	4600	2530

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[1] With cable top entry/exit additional 200 mm is required in frame sizes R11i and R12i.

Noise

The noise values of the ACS800-17 units are given below.

Type	Noise (dB)	Type	Noise (dB)	Type	Noise (dB)
ACS800-17-0120-3	63	ACS800-17-0100-5	63	ACS800-17-0120-6	63
ACS800-17-0185-3	63	ACS800-17-0140-5	63	ACS800-17-0205-6	63
ACS800-17-0225-3	63	ACS800-17-0215-5	63	ACS800-17-0255-6	63
ACS800-17-0265-3	63	ACS800-17-0255-5	63	ACS800-17-0315-6	63
ACS800-17-0335-3	63	ACS800-17-0325-5	63	ACS800-17-0375-6	63
ACS800-17-0405-3	63	ACS800-17-0395-5	63	ACS800-17-0485-6	63
ACS800-17-0630-3	68	ACS800-17-0495-5	63	ACS800-17-0750-6	68
ACS800-17-0765-3	68	ACS800-17-0770-5	68	ACS800-17-0900-6	68
ACS800-17-0935-3	71	ACS800-17-0935-5	68	ACS800-17-1045-6	71
ACS800-17-1125-3	71	ACS800-17-1090-5	71	ACS800-17-1385-6	71
		ACS800-17-1385-5	71		

Applicable standards

The drive complies with the following standards. The compliance with the European Low Voltage Directive is verified according to standards EN 50178 and EN 60204-1.

- EN 50178 (1997) Electronic equipment for use in power installations
- EN 60204-1 (1997) Safety of machinery. Electrical equipment of machines. Part 1: General requirements. *Provisions for compliance:* The final assembler of the machine is responsible for installing - an emergency-stop device
- EN 60529: 1991 (IEC 60529) Degrees of protection provided by enclosures (IP code)
- IEC 60664-1 (1992) Insulation coordination for equipment within low-voltage systems. Part 1: Principles, requirements and tests.
- EN 61800-3 (1996) + Amendment A11 (2000) EMC product standard including specific test methods
- UL 508C UL Standard for Safety, Power Conversion Equipment, second edition
- CSA C22.2 No. 14-95 Industrial control equipment

Materials

Enclosure	**Coating thickness**	**Colour**
hot-dip zinc coated steel sheet 1.0 to 2.5 mm with polyester thermosetting powder coating in visible surfaces	60 μm	RAL 7035 light beige semigloss
Flat busbars		
aluminium (standard), copper (optional), tin plated copper (optional)		
Package		
wood or plywood (seaworthy package). Plastic covering of the package: PE-LD, bands PP or steel.		

Transportation

Length: max. 4 metres, weight max. 2400 kg

Position: upright

Max. crate dimensions:

length shipping length + 100 mm

depth shipping split depth + 150 mm

height cabinet height + 80 mm

Max. seaworthy dimensions:

length shipping length + 200 mm

depth shipping split depth + 185 mm

height 2200 mm

Disposal

The drive contains raw materials that should be recycled to preserve energy and natural resources. The packing materials of the drive units and options are environmentally compatible and recyclable. All metal parts can be recycled. The plastic parts can either be recycled or burned under controlled circumstances, according to local regulations. If recycling is not feasible, all parts excluding electrolytic capacitors can be landfilled. The DC capacitors of the unit contain electrolyte which is classified as hazardous waste. They must be removed and handled according to local regulations.

For further information on environmental aspects, please contact your local ABB distributor.

CE marking

A CE mark is attached to the drive to verify that the unit follows the provisions of the European Low Voltage and EMC Directives (Directive 73/23/EEC, as amended by 93/68/EEC and Directive 89/336/EEC, as amended by 93/68/EEC).

Definitions

EMC stands for **E**lectro**m**agnetic **C**ompatibility. It is the ability of electrical/electronic equipment to operate without problems within an electromagnetic environment. Likewise, the equipment must not disturb or interfere with any other product or system within its locality.

The EMC Directive defines the requirements for immunity and emissions of electrical equipment used within the European Union. The EMC product standard [EN 61800-3 + Amendment A11 (2000)] covers requirements stated for drives.

First environment includes establishments connected to a low-voltage network which supplies buildings used for domestic purposes.

Second environment includes establishments connected to a network not supplying domestic premises.

Restricted distribution: mode of sales distribution in which the manufacturer restricts the supply of equipment to suppliers, customers or users who separately or jointly have technical competence in the EMC requirements of the application of drives.

Unrestricted distribution: mode of sales distribution in which the supply of equipment is not dependent on the EMC competence of the customer or user for the application of drives.

Compliance with the EMC Directive

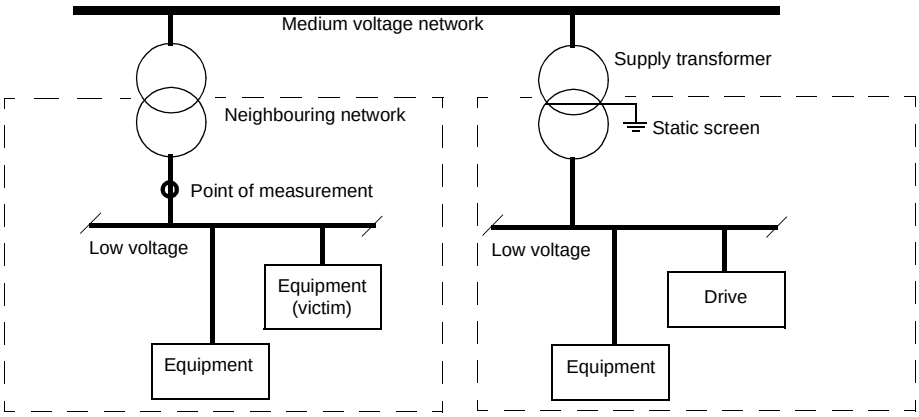
Second environment

The requirements of the EMC Directive can be met as follows:

1. The motor and control cables are selected as specified in the *Hardware Manual*.
2. The drive is installed according to the instructions given in the *Hardware Manual*.
3. Maximum cable length is 100 metres.

When the cable length is over 100 metres, the requirements of the EMC Directive can be met as follows for restricted distribution:

1. It is ensured that no excessive emission is propagated to neighbouring low-voltage networks. In some cases, the natural suppression in transformers and cables is sufficient. If in doubt, the supply transformer with static screening between the primary and secondary windings can be used.



2. An EMC plan for preventing disturbances is drawn up for the installation. A template is available from the local ABB representative.
3. The motor and control cables are selected as specified in the *Hardware Manual*.
4. The drive is installed according to the instructions given in the *Hardware Manual*.

Machinery Directive

The drive complies with the European Union Machinery Directive (98/37/EC) requirements for an equipment intended to be incorporated into machinery.

CSA marking

The CSA marking is often required in North America. CSA marked ACS800-17 drives are available on request up to 600 V.

The drive is suitable for use in a circuit capable of delivering not more than 65 kA rms symmetrical amperes at 600 V maximum.

The drive provides overload protection in accordance with the CSA standard C22.2 No 14 and the National Electrical Code (US). See *ACS 800 Firmware Manual* for the parameter setting. The setting is OFF by default; it must be activated at start-up.

The drive is to be used in a heated indoor controlled environment. See section *Ambient conditions* for specific limits.

“C-tick” marking

“C-tick” marking is required in Australia and New Zealand. A “C-tick” mark is attached to each drive in order to verify compliance with the relevant standard (IEC 61800-3 (1996) – Adjustable speed electrical power drive systems – Part 3: EMC product standard including specific test methods), mandated by the Trans-Tasman Electromagnetic Compatibility Scheme.

Definitions

EMC stands for **E**lectro**m**agnetic **C**ompatibility. It is the ability of electrical/electronic equipment to operate without problems within an electromagnetic environment. Likewise, the equipment must not disturb or interfere with any other product or system within its locality.

The Trans-Tasman Electromagnetic Compatibility Scheme (EMCS) was introduced by the Australian Communication Authority (ACA) and the Radio Spectrum Management Group (RSM) of the New Zealand Ministry of Economic Development (NZMED) in November 2001. The aim of the scheme is to protect the radiofrequency spectrum by introducing technical limits for emission from electrical/ electronic products.

First environment includes establishments connected to a low-voltage network which supplies buildings used for domestic purposes.

Second environment includes establishments connected to a network not supplying domestic premises.

Restricted distribution: mode of sales distribution in which the manufacturer restricts the supply of equipment to suppliers, customers or users who separately or jointly have technical competence in the EMC requirements of the application of drives.

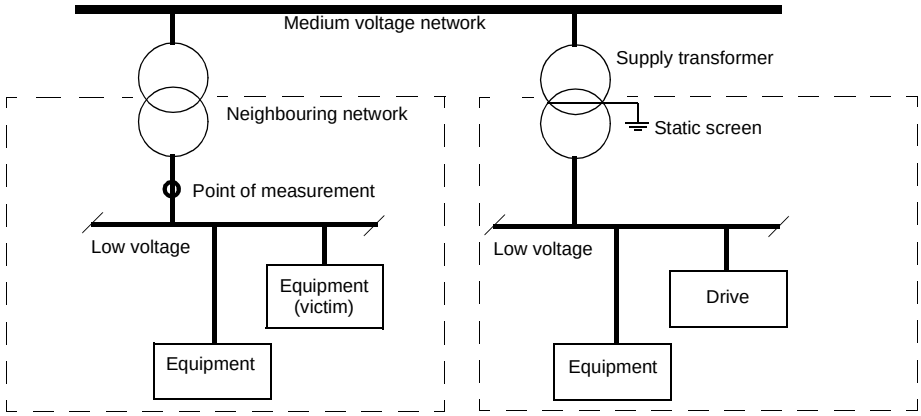
Unrestricted distribution: mode of sales distribution in which the supply of equipment is not dependent on the EMC competence of the customer or user for the application of drives.

Compliance with IEC 61800-3

Second environment

The drive complies with the limits of IEC 61800-3 with the following provisions:

1. It is ensured that no excessive emission is propagated to neighbouring low-voltage networks. In some cases, the natural suppression in transformers and cables is sufficient. If in doubt, the supply transformer with static screening between the primary and secondary windings is strongly recommended.



2. The drive is installed according to the instructions given in the *Hardware Manual*.
3. The motor and control cables used are selected as specified in the *Hardware Manual*.

Equipment warranty and liability

The manufacturer warrants the equipment supplied against defects in design, materials and workmanship for a period of twelve (12) months after installation or twenty-four (24) months from date of manufacturing, whichever first occurs. The local ABB office or distributor may grant a warranty period different to the above and refer to local terms of liability as defined in the supply contract.

The manufacturer is not responsible for

- any costs resulting from a failure if the installation, commissioning, repair, alternation, or ambient conditions of the drive do not fulfil the requirements specified in the documentation delivered with the unit and other relevant documentation.
- units subjected to misuse, negligence or accident
- units comprised of materials provided or designs stipulated by the purchaser.

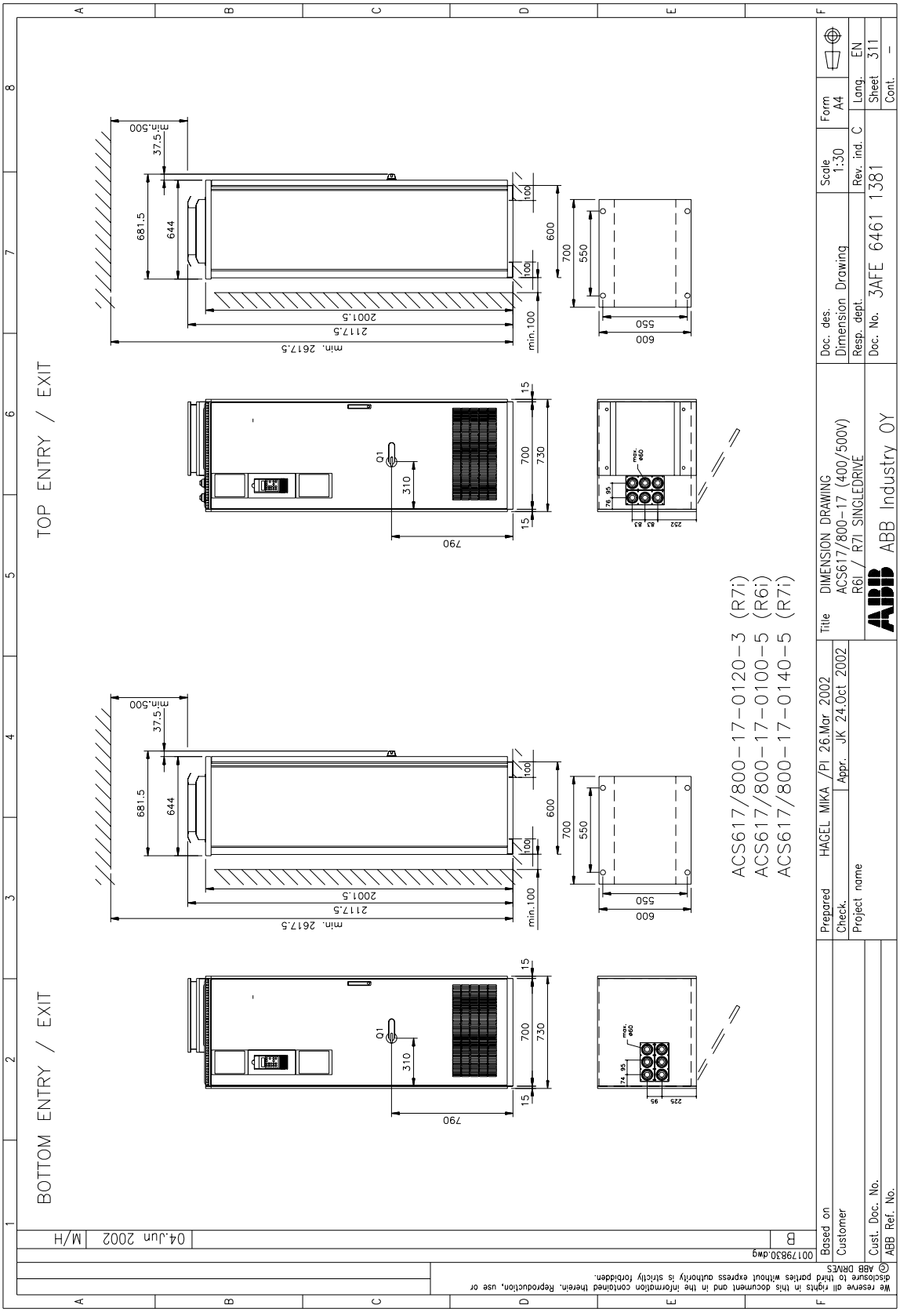
In no event shall the manufacturer, its suppliers or subcontractors be liable for special, indirect, incidental or consequential damages, losses or penalties.

If you have any questions concerning your ABB drive, please contact the local distributor or ABB office. The technical data, information and specifications are valid at the time of printing. The manufacturer reserves the right to modifications without prior notice.

Dimensional drawings

What this chapter contains

This chapter contains the dimensional drawings of ACS800-17 frame sizes R6i to R12i.



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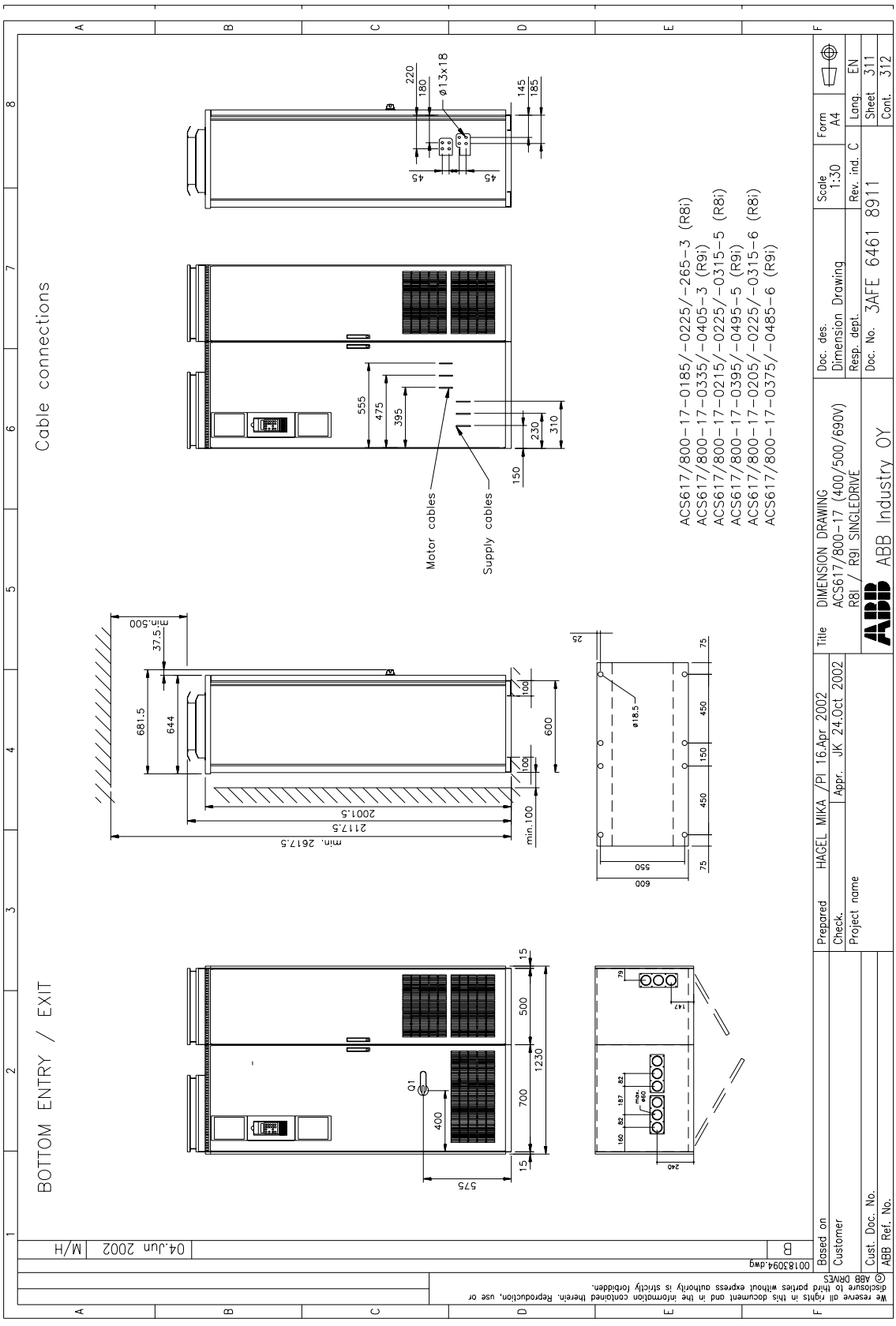
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ACS617/800-17-0335/-0405-3 (R9i)
ACS617/800-17-0215/-0225/-0315-5 (R8i)
ACS617/800-17-0395/-0495-5 (R9i)
ACS617/800-17-0205/-0225/-0315-6 (R8i)
ACS617/800-17-0375/-0485-6 (R9i)
Motor cables
Supply cables
DIMENSION DRAWING
ACS617/800-17 (400/500/690V)
R8I / R9I SINGLEDRIVE
ABB Industry OY
Doc. No. 3AFE 6461 8911
Scale 1:30
Form A4
Lang. EN
Sheet 311
Cont. 312
Prepared HAGEL MIKA /PI 16.Apr 2002
Check. Appr. JK 24.Oct 2002
Project name
Based on
Customer
Cust. Doc. No.
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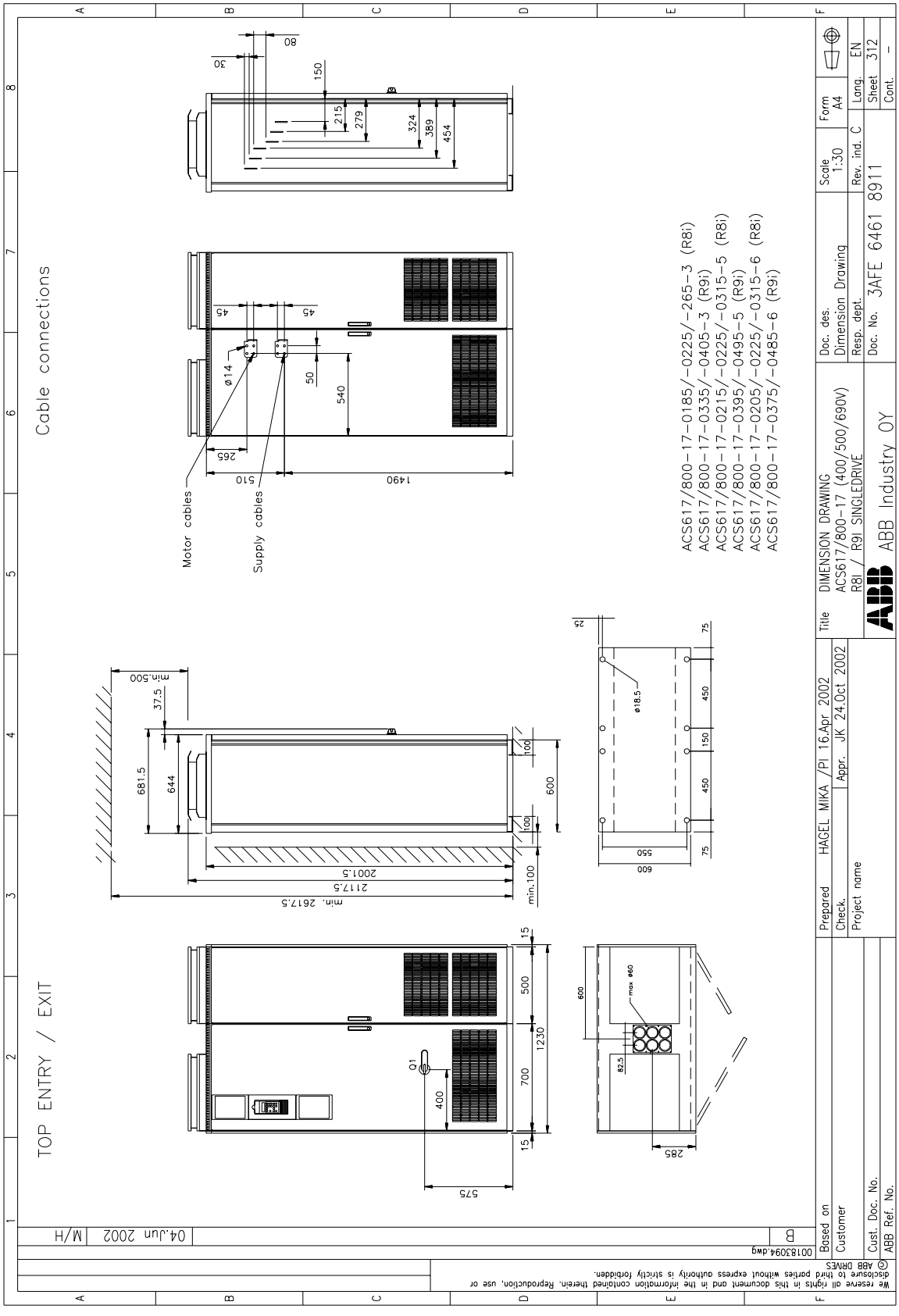
Cable connections
TOP ENTRY / EXIT
Motor cables
Supply cables
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ACS617/800-17-0335/-0405-3 (R9i)
ACS617/800-17-0215/-0225/-0315-5 (R8i)
ACS617/800-17-0395/-0495-5 (R9i)
ACS617/800-17-0205/-0225/-0315-6 (R8i)
ACS617/800-17-0375/-0485-6 (R9i)
DIMENSION DRAWING
ACS617/800-17 (400/500/690V)
R8i / R9i SINGLEDRIVE
ABB Industry OY
3AFE 6461 8911
Prepared HAGEL MIKA /PI 16.Apr 2002
Check. Appr. JK 24.Oct 2002
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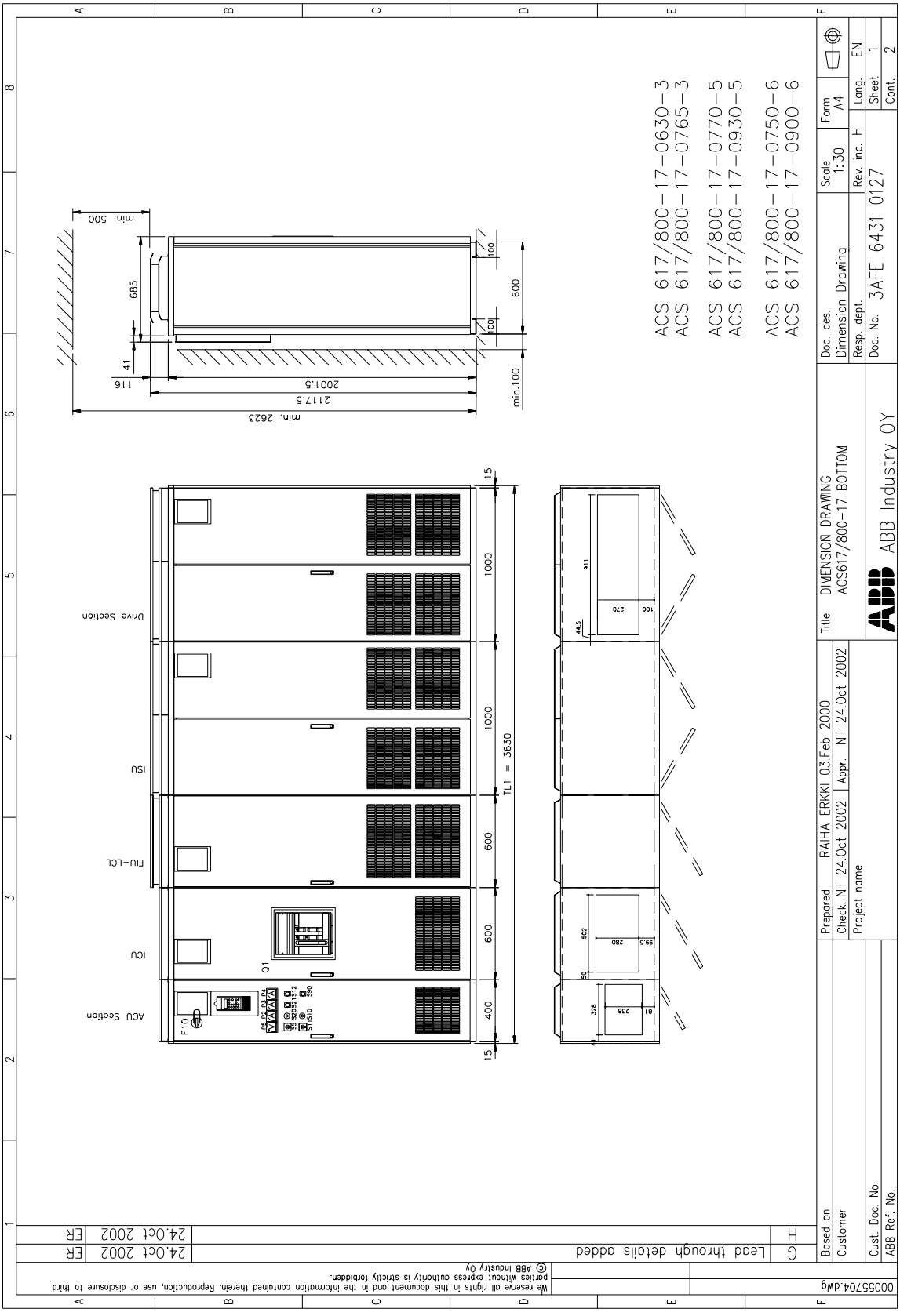
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ACS 617/800-17-0750-6
ACS 617/800-17-0900-6
DIMENSION DRAWING
ACS617/800-17 BOTTOM
ABB Industry OY
Lead through details added
ACU Section
ICU
FIU-LCL
ISU
Drive Section
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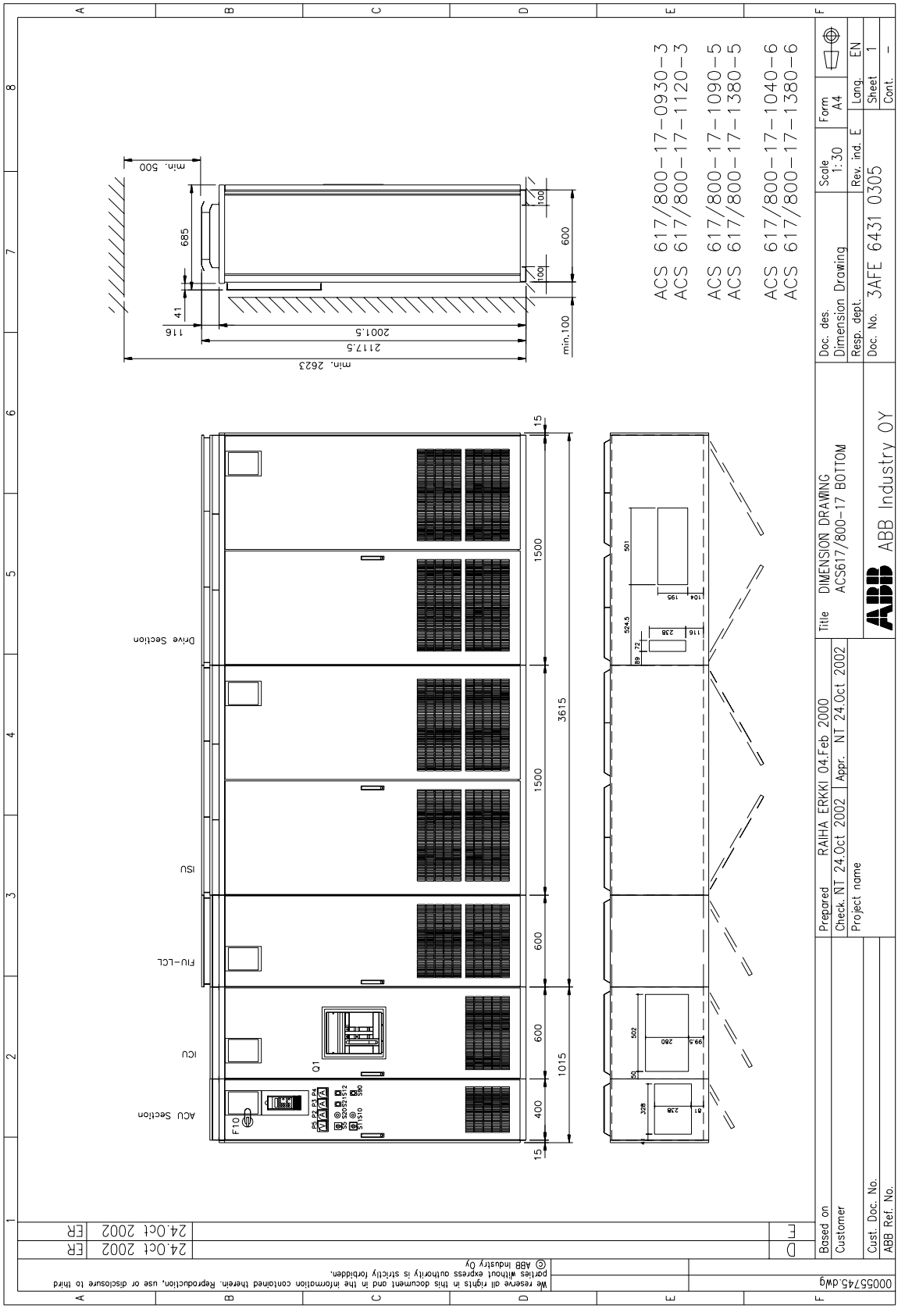
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DIMENSION DRAWING
ACS617/800-17 BOTTOM
ABB Industry OY
3AFE 6431 0305
Dimension Drawing
Scale 1:30
Form A4
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Doc. No.
Resp. dept.
Doc. des.
Prepared RAIHA ERKKI 04.Feb 2000
Check. NT 24.Oct 2002
Appr. NT 24.Oct 2002
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ABB Ref. No.
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24.Oct 2002 ER
24.Oct 2002 ER
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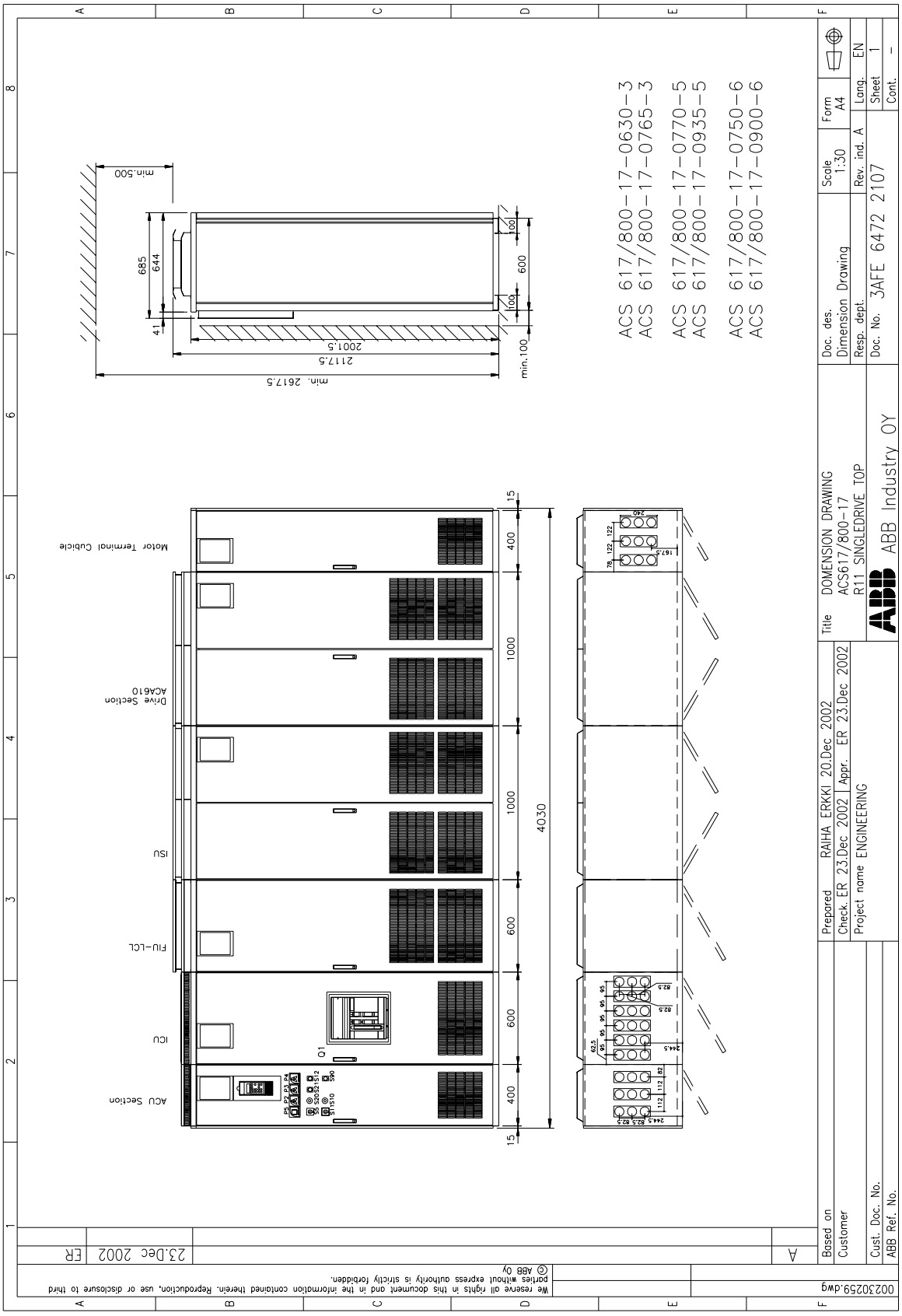
ACU Section
ICU
FIU-LCL
ISU
Drive Section
F10
Q1
X1
X2
S1S10
min. 500
685
41
116
2117.5
2001.5
min.100
min. 2623
100
600
1500
3615
1015
400
15
501
524.5
502
280
328
238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ACS 617/800-17-0900-6
Motor Terminal Cubicle
Drive Section
ACA610
ISU
FIU-LCL
ICU
ACU Section
4030
min.500
2617.5
2117.5
2001.5
685
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600
Doc. No. 3AFE 6472 2107
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DOMENSION DRAWING
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23.Dec 2002 ER
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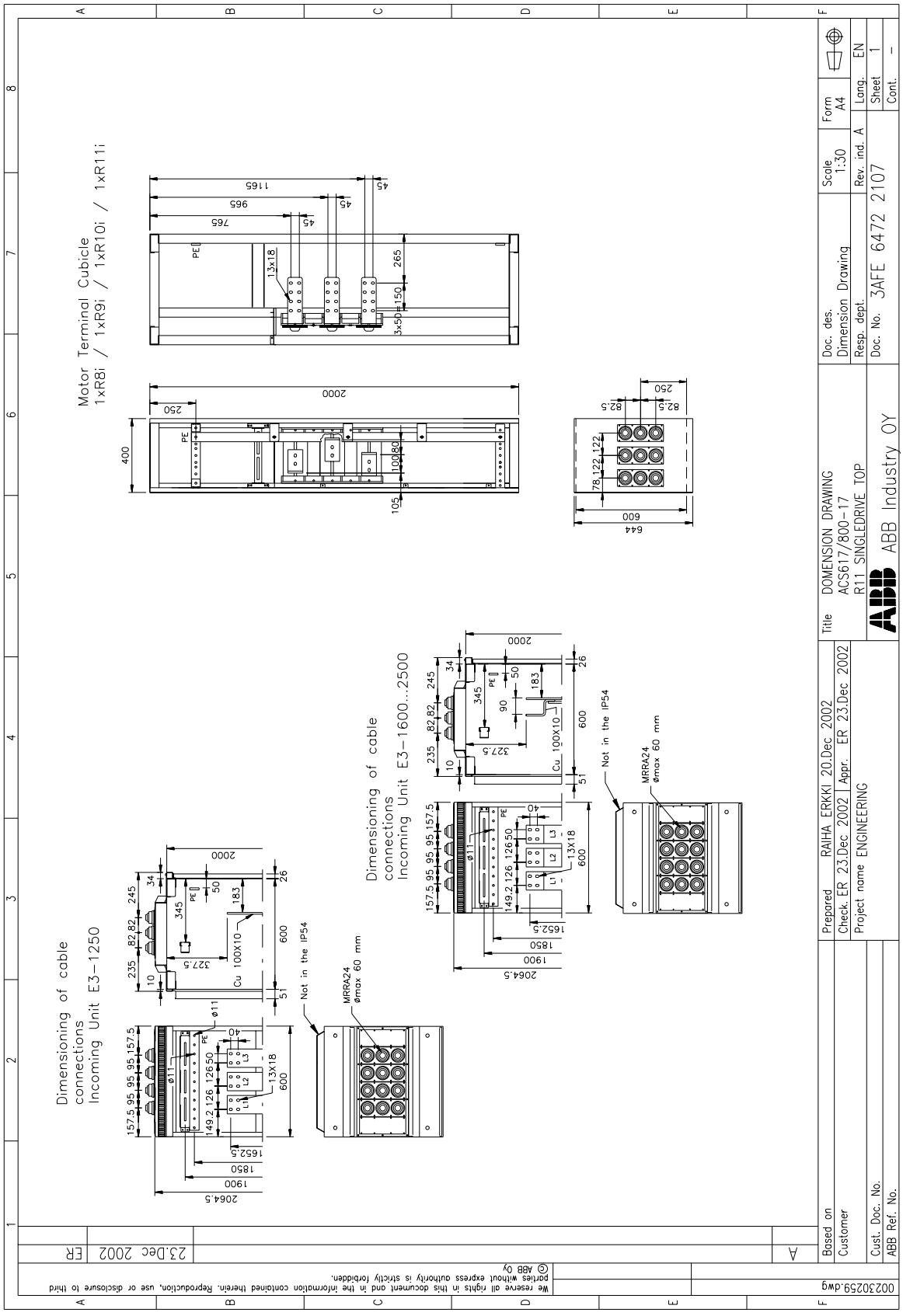
Motor Terminal Cubicle
1xRBi / 1xR9i / 1xR10i / 1xR11i
Dimensioning of cable connections
Incoming Unit E3–1250
Dimensioning of cable connections
Incoming Unit E3–1600...2500
MRRA24
Ømax 60 mm
Not in the IP54
ABB Industry OY
DOMENSION DRAWING
ACS617/800–17
R11 SINGLEDRIVE TOP
3AFE 6472 2107
RAIHA ERKKI 20.Dec 2002
ER 23.Dec 2002
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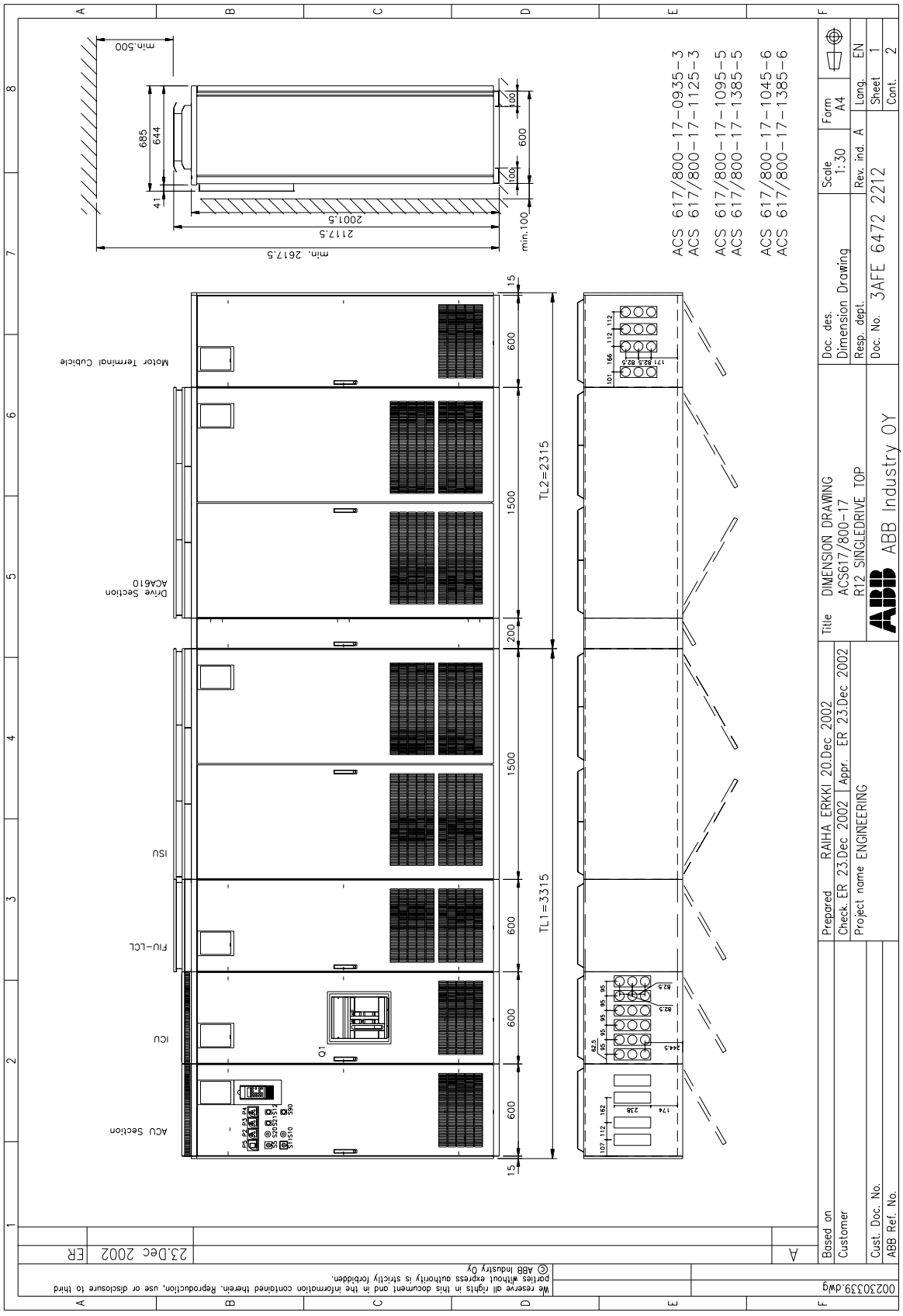
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ACU Section
ICU
FIU-LCL
ISU
Drive Section ACA610
Motor Terminal Cubicle
TL1=3315
TL2=2315
DIMENSION DRAWING
ACS617/800-17
R12 SINGLEDRIVE TOP
ABB Industry OY
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Dimension Drawing
RAIHA ERKKI 20.Dec 2002
ER 23.Dec 2002
ENGINEERING
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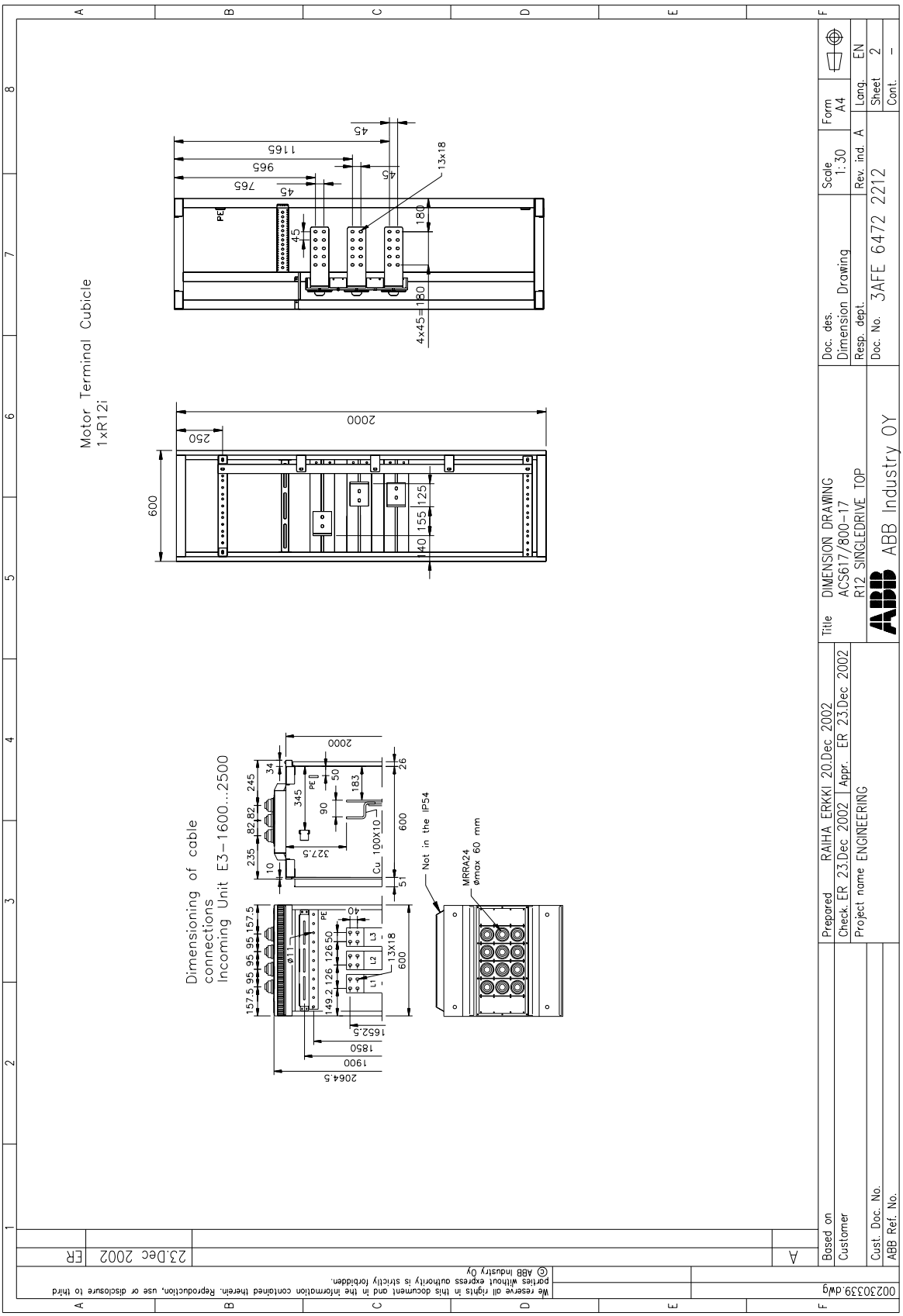
23.Dec 2002 ER


Motor Terminal Cubicle
1xR12i
Dimensioning of cable connections
Incoming Unit E3-1600...2500
Not in the IP54
MRRA24
ømax 60 mm
13x18
4x45=180
2000
600
250
Cu 100X10
Doc. des. Dimension Drawing
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Form A4
Rev. ind. A
Lang. EN
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ABB Industry OY
Prepared RAIHA ERKKI 20.Dec 2002
Check ER 23.Dec 2002 | Appr. ER 23.Dec 2002
Project name ENGINEERING
Based on
Customer
Cust. Doc. No.
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ABB Oy
AC Drives
P.O. Box 184
FIN-00381 HELSINKI
FINLAND
Telephone +358 10 22 11
Telefax +358 10 22 22681
Internet http://www.abb.com

ABB Inc.
Drives and Power Electronics
16250 West Glendale Drive
New Berlin, WI 53151
USA
Telephone 262 785-3200
800 243-4384
Telefax 262 780-5135